

ARS TEXTRINA

A Journal of Textiles and Costume

VOLUME TWENTY-NINE

JUNE, 1998

WINNIPEG, CANADA

Veronika Gervers Research Fellowship in Textile and Costume History

The Veronika Gervers Research Fellowship, supported by a fund established in 1979, exists to promote research incorporating the textile collections of the Royal Ontario Museum, leading to publication. *Applications are encouraged from all areas of textile and costume history.* An annual fellowship of up to \$9000.00 is available to Ph.D. candidates, junior and senior scholars whose research can make direct use of, or support, any part of the ROM collections. The award will cover travel and living expenses while in Toronto to do related research.

Eligibility

Eligibility for the Fellowship is determined by a committee of scholars from the museum and university communities who will decide on the successful application. Any adult, regardless of sex, race, religion or national origin may apply. Successful foreign applicants are responsible for obtaining any necessary visas, permits, etc.

Dates and Deadlines

Applications must be received by *November 15* and notification of results will be made on or before *January 31* each year.

Requirements of Successful Applicant

The successful applicant must spend all or part of the time in residence in Toronto working at the ROM. In addition, that person is expected to give the annual Veronika Gervers Memorial lecture based on his or her work to date.

For further information on the fellowship, please contact Chair, Veronika Gervers Memorial Fellowship, Textile Department, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario, Canada M5S 2C6; (416)-586-5790.

Pinna And Her Silken Beard: A Foray Into Historical Misappropriations

Daniel McKinley

Contents

Undocumented Prologue	2
An Old-fashioned Name: Getting Acquainted	11
The Greek Connection: What Aristotle Probably Did Not Say	14
What About Jason and His Golden Fleece?	18
Pinna and the Pinna-guard in Greece, Rome and Hellenistic Egypt, Through the Time of Pliny	22
Adventures on the Erythrean Sea: The Question of Sea-silk in India	31
Sea-silk: Christian Scribes, Pagan Philosophers, Diocletian's Price-fixing and the Age of Bestiaries	40
Oriental Translations: Pinna Wool, Aquatic Sheep and Mermaid Fleece	59
A Western Splinter: The Arabs in Spain and Northern Africa – The Water Sheep, Part Two	67
Alarums and Excursions: Maids in Scanties, Waterweeds and a Marine Fish	86
And 'Cloth of Gold'?	93
What Do You Mean, " 'Twas Byssus?" – "And the Slithy Toves ..."	97
Naked, 'Though Fully Clad: Was Sea-silk Ever Made into Diaphanous Fabric?	111
Science Demonitizes Pinna and Cripples the Pinna-guard	127
Pinna at Taranto: Birth? Rebirth? The Nine Deaths of the Sea-silk Industry	144
A Comic Relief: Pinna in Fiction	177
Bibliography of Cited Titles	180
Acknowledgments, With a Note on Methods	211

Undocumented Prologue

A modern invertebrate zoologist will tell you that *Pinna* is the generic name of several species of marine bivalve mollusks found in the Mediterranean, the tropical Atlantic from Africa to North America and from eastern and southern Africa and India to Japan, Australia and the Pacific islands.

A well-read naturalist will know more. *Pinna*'s history goes back to Aristotle and the abundant folk-sources that he tapped. Maybe he will also report that Mediterranean peoples ate the mussel-like flesh of *Pinna* – but Greeks and Romans appear to have eaten anything when it was properly sauced. Later authorities agree that the flesh is edible but of indifferent quality, reminding one a little of the elaborate spoof of cooking a shad on a board – and then eating the board.

Your naturalist will also probably report that the ancients believed every *Pinna* had her commensal crab – her *Pinna*-guard – who warned of danger, lured fishes into her mantle cavity, helped her to trap them and shared in the resulting feast. The same sources averred that neither *Pinna* nor the Guard could live without the other. It was as fabulous a piece of nonsense as the hoary story of the Barnacle Goose: but without the benefits of the latter belief, which enabled people in Catholic countries to eat those geese on fish days.

As for *Pinna* and the Guard (*Pinnophylax* or *Pinnoteris*), their cozy relationship never benefitted the human race beyond its being cited in moralistic commentaries and analyses of dreams as an example of Divine Providence in providing us with a guide to ethical conduct: an example, that is, of unselfish behavior on the part of a lowly crab. (Cynics suspected, even in those early times, that the crab might be a kind of social parasite, eating at the same table as *Pinna*, or at least simply secreting its tiny, soft body within *Pinna*'s protective shell; that does not much matter: the point is that all were dealing with familiar stories from which they drew familiar morals.)

The naturalist will surely also tell you that *Pinna* has a diffuse silken beard, up to some six inches in length and of exceeding fineness and strength. This the animal secretes, as an anchor for itself in its sandy or muddy substrate. Although physiologically and anatomically sim-

ilar, this anchor is much less coarse than the bundle of bristles by which a blue-mussel attaches itself to a rock or other object in the tidal zone.

With this silken beard, our story of *Pinna* is properly launched. In its telling, this tale taps the riches of past lore. It will also touch base at the doorstep of modern biological science and its keen interest in the biochemistry and biophysics of incredibly versatile glues and of fibers, made of a strong, resistant and pliable substance that can be formed and cured within a fluid environment.

The story finally leads to accounts where a great deal of nonsense has been promoted right into our own time, beliefs whose bases in fact in no way differ from folk tales of the past.

To begin with, since about the beginning of modern science, we have called this tuft of silken fibers the “byssus.” The structure must have a name, of course, and this will do. An explanation must wait its turn, but the term has led to multiple confusion, as experts in many fields peddle their wares under what seems to be the same word. How can you blame those experts if some of them mistake byssus for “byssos” or “bussos,” a somewhat mysterious fabric of plant origin that is often reported, variously characterized and sometimes misidentified?

Thereby hangs considerably more than a tale of *Pinna*. You will be told that the fine, silky and strong fibers of *Pinna* have long been gathered, cleaned and spun as a substitute for the fabled and costly silkworm silk of the Orient. Or ... was it somehow more than a substitute? Was it not a substance valued for itself alone?

Modern folklore – and the folk element is ever alive within us – also has it that there was an industry based upon the silk of *Pinna*. It was widespread in Mediterranean lands and had a continuous and long-standing history. Naturalists have tended uncritically to adopt this view.

Some naturalists unblushingly repeat the fiction that Jason and his crew of Argonauts were in search of fabrics made of the silk of *Pinna*. It was, they say, the stuff of the Golden Fleece. That story, I think,

is stuff indeed.

The historian of natural history goes on, sketching a tale that stretches from the Greco-Roman Mediterranean to Chinese traders interacting with early merchants from the Middle East, to the Moors in Spain, all of whom gullibly told and retold – perhaps half believed – as true a wild story that originated among natives of the Mediterranean region.

The story had it that, in contrast to peoples dependent upon Earthly creatures merely, *they* had a Marine Sheep that yielded wool of great beauty and rarity. Some made the silken beard a kind of navel cord by which that strange sheep was attached to its watery substrate. There were claims that, if you induced the creature to break the cord, it could be shredded into the precious golden fleece of Pinna's Sea-silk. Whether this story led onward and landward to the fabulous Vegetable Lamb of Tartary is another facet of an ever-varying elaboration of what people wanted to believe.

Some commentators have thought that Sea-Silk, a burnished, naturally glistening red golden color, without dyeing, could be woven into cloth so beautiful and rare that it was worth its weight in gold, if not more. Others, uncritically, said that it was not merely golden in color, it was known as Cloth of Gold: indeed, that term really meant cloth made of Pinna silk. This ignores the fact that metallic gold has long been made into fine threads and incorporated into fabrics of fabulous cost.

These pretty fancies that Sea-silk is the constituent of Cloth of Gold and that Sea-silk was often made into garments of considerable dimension have been adopted by people who ought to know better.

Such modern fabulists will tell you (correctly) that King Henry VIII of England met King Francis I of France near Calais in 1520, on the 'Field of Cloth of Gold.' Then, without a blush, they will inform you that the place was so named from the vast quantity of pennants and garments and rich trappings made of the 'cloth of gold' of Pinna's Sea-silk. The trappings, I have no doubt, were cloth of metallic gold only.

As with Cloth of Gold, there is the matter of cloth of extreme fineness, long since drawn into the general modern fable of Pinna and Sea-silk. You hear that Sea-Silk was woven into passingly diaphanous fabrics, so fine that you could draw a great sheet of it through a finger ring, so transparent that the shimmering bodies of dancing girls were displayed enticingly for all to see, even though multiple layers of the fabric were worn. This pleasant story goes back at least to the steamier sides of Greece and Rome (the Better Elements, of course, were above all that sort of thing).

No doubt such fabrics were made. But were they ever made of fabric composed of Sea-silk?

There were, for example, the fabled woven fabrics of Taranto – so well known that the term 'Tarantine' refers to just such luxurious trappings. Some have intimated, but with no proof that I can see, that Tarantine was made of Sea-silk.

In India, the finest fabrics were muslins made of cotton. We are told of Bengal weavers who made muslins so diaphanous that, when spread to dry, cows ate them, unable to distinguish them from the grass of the meadow. In Pakistan today, textile museums demonstrate the fineness of ancient Dakha muslins (everybody agreeing that nothing found in modern technology equals them) by showing that you can read the words on a calling card through seven layers of fabric.

Now, such was the elegance of techniques of ancient hand-spinners in various parts of the world, in the fineness of their products, that they defy copying by any modern technology. The result was – or could be – a textile fine enough that one's body or undergarments could be plainly discerned through it. Examples of such diaphanous textiles clearly show in many drawings or are reported in written accounts from ancient cultures as diverse as India, Egypt, Greece and Rome. Was the Sea-Silk of Pinna ever used to produce such textiles? Many writers blithely assume that to be the case, basing their statements, it seems to me, mostly on the fact that fabrics of some sort made of Sea-silk did exist and that, for various reasons, they were held in high repute. Yes, rave reviews were given Sea-silk for its lowly origin.

It was lauded for its coloring that neither needed dyeing nor could be improved upon. But no early author expressly claimed that the cloth was diaphanous. Later writers jumped to what may be unwarranted conclusions about its fineness. French naturalists of the eighteenth century were quite clear about Sea-silk: whatever its beauty and novelty, it was coarse when compared to silkworm silk. Articles that you see today, beautiful as they are, are never diaphanous and do not approach that condition.

Fine cloth can be documented back into early Rome, Greece, Egypt and India. No such early cloth has been proved to be made of Sea-silk; most of it can be proved to have been made of diverse other materials. The use of Sea-silk to make any sort of fabric was unknown to Aristotle (384-322 BC) and his many informants. Nor did the man whom we call Pliny the Elder (d. 79 AD), whose eclectic net partook even-handedly of all sources, ever hear of such use, even though he was in the heart of the seascape we now associate with Pinna and fabrics made of Sea-silk.

Pliny brings us to the end of the first century AD: and, suddenly it seems, learned scribes began to write of Pinna's lowly origin and of the inimitable beauty of Sea-silk. It taught its moral lesson even as it sang of the glory of God. Even admitting that the learned ones copied generously from each other (of what else does learning consist?), something significant had happened. Sea-silk was suddenly being made into fabrics.

Since modernists are reluctant to believe in the spontaneous generation of anything, even of an industry, guesses have been rife, allegations common and the hedging of bets frequent. One authority in the last century put the birth and perfecting of the Sea-silk industry in a foreign land, beyond the recall of history. The Mediterranean West got its notions of fine cloths made from Sea-Silk, he wrote, from India. Those fabrics were imported into the Mediterranean world by early traders by way of Egypt, sailing small crafts easterly across what was called the Erythrean Sea.

Without doubt, there are Pinna mussels aplenty in the fabled pearl-mussel beds of the strait between Ceylon and southeastern India.

True enough, India's land and sea furnished luxurious fabrics. But I cannot find the slightest intimation, scientific or otherwise, that any exploitation of Pinna mussels for their Sea-silk ever occurred in India.

It is true that, perhaps to a fault, modern authors dismiss as too imperfect for safe interpretation, the chief lines of an ancient account of trade on the Erythrean Sea that gave rise to this theory. At best, anyway, it neatly takes us back to yet another unknown cradle for the industry where we must, under increasingly greater constraints, look anew for its roots.

What may, in fact, prove more useful as an approach is to query whether there is really any generic relationship between Sea-silk's repute in early Christian times and that home-grown industry that we know so well from modern Italy beginning maybe no earlier than around the year 1700. I incline to believe there is not. I do not account the apparent spontaneous origin of the Sea-silk industry and its rapid development in the early Christian Era a great mystery. Knowledge of spinning and weaving, of a great variety of fibers, some of which would be thought novel today, was well known. The rarity and high cost of silkworm silk, both Oriental and that from certain native caterpillars, must have been a spur to find a substitute. A similar scenario may be admitted for Taranto in later times, except that wild silkworm silk was a thing of history only, if even recalled at all.

What happened in the Christian West after that initial early interest? In that long period, we hear rather little of the wonders of Pinna, her Sea-silk or cloth made from it. In the Middle Ages, that great storehouse of information and morally instructive misinformation in Latin and French bestiaries known widely as the *Physiologus* seems to have overlooked Pinna and Pinna-guard. A few bestiaries do touch briefly upon mollusks (oysters and pearls, mostly) and a Syriac version of the *Physiologus* mentions cloth made of Sea-Silk. With St. Albert, a slow rediscovery of Pinna began, but it was more a rebirth of curiosity about nature and the history of nature than any recrudescence of interest in a source of fibers.

True, there is the matter of Pinna and Sea-silk in Arabic Spain and North Africa, Sea-silk being known by many names, perhaps notably as the fabled *abu qalamun*. *Abu qalamun*, we are told, was a monopoly of the Moorish princes in Spain, whose collectors and weavers are now claimed to have succeeded in amassing enough Sea-silk to manufacture gorgeous fabrics and perhaps even carpets. With all that, much of which is imprecise, circumstantial and fabulous, Arab writers kept alive, until times parallel to the end of the European Middle Ages and the beginning of the Renaissance, wondrous tales of water sheep and woven stuffs whose glorious colors varied not only with the angle at which you viewed them but even by the time of day. Claims that the latter fabrics were invariably made of Sea-silk are dubious.

Anyway, knowledge of Pinna and Sea-silk died separate deaths in Christian and Moorish cultures.

Then – perhaps suddenly? – interest in Sea-silk in the Mediterranean, from Grecian Italy through Sicily and both coasts of France, was renewed. Partly, perhaps, it was due to interests of the great cataloguers of nature, such as Gessner and Rondelet, down to Linnaeus and his colleagues, to have names for everything. Travelers, too numerous to name, broadened horizons of knowledge, if not always careful of the depth to which they dug for facts. More sceptical elucidators of nature (Réamur, Geoffroy the Younger, some of the Encyclopaedists) looked beyond names and the trite tales of yore, leading slowly to a fresh look at nature.

There was probably also an interest in a local source of a cheap substitute for silk, in areas of the Mediterranean that had become centers for cultivation and weaving of silk from domestic silk-worms. Right away, beginning little if any before 1700, it seems that every traveler returned from southern Italy with much the same tale of a Silk-worm of the Sea. We hear of the fishing for Pinna (whether always for its Sea-silk is not clear), of elaborate devices that were used to pull the animals from their abodes, of processes by which Sea-silk was cleaned, spun into threads and knitted (apparently never woven) into prized articles of clothing, mainly stockings, gloves, caps and, maybe, capes. Such articles – the best accounts relate that even

then Sea-silk was mixed with regular silk to give it strength – were popular with tourists and they made acceptable gifts for visiting dignitaries of the Church, perhaps as much because of the devotion they exemplified in so patiently gathering such rare fibers as from the novelty of the material. There is little information on dimensions of the industry: but the *idea* of Sea-silk was certainly current.

What detrimental influences ended the industry can only be guessed at. Very likely, over-fishing was a major factor in its demise. Ultimately, no doubt, pollution destroyed many choice habitats. Hard-nosed economics must also have been involved. Silk-worm silk, no longer a costly imported fiber but a local product, was cheap and industrialization of the weaving industry enhanced its dominance. Maybe a contributing factor was the gradual disappearance of cheap labor in orphanages and nunneries: who could then afford the luxury of spending so much time turning the rare tufts of raw Sea-silk into a cape for the Pope or even a pair gloves for one of his visiting emissaries?

The industry has had its propagandists and its dotting historians. Promoters of local products have been many and persistent. One must treasure ancient ways. Local resources must be preserved and used. In our time, we have read how we must add to the glory and economic independence of Fascist Italy. But it was in vain and one hears today not of an industry based upon Sea-silk but of efforts to replant Pinna in fragmented and degraded bits of habitat still available to it, of efforts to restore and expand that habitat.

The following chapters explore by-ways of our rich past. We hear of blind Pinna and her watchful Pinna-guard. We read of Aristotle and Pliny. There is the matter of Jason and his Golden Fleece.

There are adventures on the Erythrean Sea, as we gain acquaintance with early Christian Fathers, philosophers and moralizers and, even Diocletian's price-fixing, all sticky realms of many claims and few facts.

What of the China trade and that story of the aquatic sheep? How do we fit in the Moors of Spain and northern Africa?

The story of Pinna and Sea-silk since the Renaissance takes into account a tangle of many aspects of legitimacy and bastardy in modern terminology. A major part of this centers on the word *byssus*. That word was suddenly applied to Pinna's tuft of Sea-silk, allegedly but dubiously upon the authority of Aristotle.

Unfortunately, there was always some imprecision in the use of that word (or one similar to it). To some extent, this uncertainty need not bother us, for by all accounts the word always meant a fiber derived from plants, never from an animal.

Mollusks and the parts of mollusks had to be named and out of the many-faceted levels of the nomenclatural cauldron we see Gaza, Rondelet and Linnaeus at work firmly announcing new uses for an old word. Later scholars happily began to mix new meanings and old uses.

With so much uncertainty from the past so freely intermixed with uncertainties of later times, where is one to begin untying the Gordian Knot?

Does one say that the modern Sea-silk industry was born in 1700? Was the industry ever dead? The story of Taranto, Tarantine cloth, the knitting of Sea-silk and the sporadic efforts to rejuvenate the Sea-silk industry, all represent a tangle of assumptions and claims and obscure facts that defy easy elucidation.

My studies lead me to fly in the face of a good many modern conclusions about Pinna and Sea-silk. It is sad that no matter how little evidence there is for a cherished belief, a request for evidence is viewed with hurt suspicion.

The even-handedness of lexicographers, such as authors of the *OED*, introduces unweighed statements that are easy to misuse and that fail to emphasize that old meanings have been violated.

Mary S. Gardiner, a modern invertebrate zoologist, is but one of many writers to give a gloss of authority to nearly every misleading and even patently wrong statement that has ever been made about Sea-silk. Cloth of Gold! The Golden Fleece! Fine cloths of old

become byssus, byssus becomes Sea-silk – and any diaphanous stuff is made of Sea-silk!

Where are *examples*? We *do* find archeological examples of silk in fair plenty: examples of Sea-silk very seldom indeed. Is it not strange that we know so little of a substantive nature about articles made of Sea-silk that do not emanate from the Italian area of the late 1700s and onwards? Can any fabric known to be made of Sea-silk be called truly diaphanous?

What is to be made of the fact that nearly every vestige of fabric known to be made from Sea-silk exhibit it made by knitting, widely believed to be a technique of fabric-making of relatively late perfection?

The chapters that follow explore in detail these webs of Pinna's history.

An Old-Fashioned Name: Getting Acquainted

Meet *Pinna nobilis* – the second name may vary, depending upon your conchological-malacological authority. For centuries before such a formal Latin name was bestowed (in this case, in 1758 by Carolus Linnaeus), the Greeks called her (the animal is feminine in Greek) Pinna. Call her, for the moment, simply Pinna: or Pen-shell or Fan-shell, if a familiar name is required. Read a guide to marine shells (such as Abbott) or technical accounts such as those by Grave, Turner and Rosewater, Winckworth and Yonge if you require more information.

This particular Pinna is one of several species of sea-bottom-dwelling mollusks of its general kind. Winckworth names the species. These animals, like clams, oysters and scallops, have shells made up of two more or less equal halves that meet in a hinge along what one thinks of as the back of the creature.

Pinnas are relatives of blue-mussels that visitors to the seashore find as living animals attached to stones, sea-walls and piers in the tidal zone. In both animals, the organ of attachment is externally a spray of strong and resilient fibers that zoologists call the byssus. The

byssus is secreted, somewhat as a silkworm makes silk, by an internal gland and laid into place by a finger-like 'foot' that forms and shapes each fiber and anchors it. The innermost part of the fiber bundle is permanently attached to internal organs of the animal. Externally, the fibers of the byssus are free from each other and end in little blobs of exceedingly strong cement that secure the animal to its chosen substrate and prevent its easy removal by predators or its certain swamping by wave and tide.

Pinna, like its blue-mussel cousin, has a tuft of byssus fibers, of a similar chemical composition and physical construction. Differences emerge, for the beard of Pinna is a generous one of many fibers, each long and, comparatively, very fine. The fibers function somewhat differently, too, for they anchor Pinna to grains of sand and other small particles of the substrate. Pinna does not dangle from its home-site: it stands upright, like an old-fashioned quill pen (hence one of its names).

Pinna has a similar American cousin, in the genus *Atrina*. Indeed, Mary S. Gardiner wrote, without further comment, "The byssus threads of *Atrina rigida*, a species found along the southeastern coast of the United States, have also been made into cloth but never for commercial purposes, which can now be fulfilled by synthetic products." This claim is not corroborated by any other authority.

Pinna is not, at maturity, a small animal. There are claims that it once commonly attained a length in excess of two feet. Naturally, such a sedentary animal could not balance itself upon its attenuated 'front' end, no matter how elaborate its byssus, unless it were deeply buried, so that the circumambient particles of the sea-bottom join the byssus as a prop to keep it upright. Pinnas often cover great areas of the sea-bottom, as Busbecq recorded – or at least did in olden times before over-fishing, marine disturbances and pollution laid them low. One could see large numbers together, each permanently situated under water, each protruding its somewhat gaping broad end above the bottom surface of the sea.

Diameters of individual fibers in Pinna's byssus differ considerably, no doubt according to the age of the animal but also within any

one spray of fibers. Figures given usually range from 10 to 100 microns, according to Mauersberger. Their lengths also vary, obviously somewhat dependent upon the length of the animal's foot, which is the formative organ of the fibers. That is to say, as Dr J.H. Waite describes the process, the fibers are not simply extruded into the surroundings but one at a time are individually formed and hardened inside a groove of the foot which ultimately attaches the terminal end of the fiber and then lifts itself free of the fiber its entire external length.

Clearly, when a Pinna is wrenched – with great difficulty! – from its snug home, a great number of fibers will be broken off short of their point of attachment. One would thus not expect to find all of them tipped with rounded blobs of cement. Should the cement be there, of course, both its presence and the fact that the byssus fibers are relatively short (in the order of six inches at most, according to authorities) would instantly distinguish a fiber of Pinna's Sea-silk from one of silkworm silk, whose fiber, unless broken, is a continuous line of material of up to many hundreds of yards in length.

This amounts to little more than a nodding acquaintance with Pinna, but it will suffice for now.

References

Abbott, R. Tucker, "Pinna and the Golden Fleece," pp. 184 + plate, in: *Kingdom of the Seashell; American Seashells*, 2nd ed., plate 27; the former is a good popular account (it is not a reference to Jason of the Argonauts); its plate illustrates a device used at Taranto, Italy, in the 18th century for fishing for Pinna; the latter work pictures shells of American species of this genus.

Busbecq, Ogier Ghiselin de, *Life and Letters*; in vol. I, he describes Pinna beds near the island of Prinkipo, in the Turkish Sea of Marmora, in the summer of 1561: "... they are very plentiful in that sea, so much so that they seem to have been artificially laid down"; he was also content that its tuft of hair was used by Pinna to suck up its nutriment: "... it dies from want of nourishment, like vegetables and plants when severed from its roots"; I owe my introduction to Busbecq to George Sarton, "Brave Busbecq (1522-1592)"; the notion that Pinna's byssus served a nutritive function did not die easily; it was still being espoused by Dezalliers d'Argenville nearly two

centuries later.

Dezalliers d'Argenville, Antoine Joseph, *La Zoomorphose*, p. 54.

Gardiner, Mary S., *The Biology of Invertebrates*, pp. 95-96. An extended search for evidences of ethnozoological use of *Atrina* as a fiber source by either aboriginal or pioneer cultures has failed to disclose any examples.

Grave, Benjamin H., "Anatomy and physiology of the wing-shell," illustrations, p. 415, pl. XLVIII.

Mauersberger, Herbert R., *Matthews' Textile Fibers*, 5th ed., pp. 728-729.

Turner, Ruth D., and Joseph Rosewater, "The Family Pinnidae in the Western Atlantic."

Waite, J. Herbert, "Mussel beards: a coming of age"; "The formation of mussel byssus: anatomy of a natural manufacturing process"; both accounts are marvels of clear exposition of complex physico-chemical processes by a leading student of byssus biochemistry; reference is primarily to the fibers produced by the common blue mussel, *Mytilis*, but basics of fiber production ought to be the same with *Pinna*.

Winckworth, M.A., "Marine molluscs from south India and Ceylon. III. *Pinna*"; the same, "Further notes"; see especially the list of all species of *Pinna*, 1929: 290-297; there is a good diagram of internal anatomy, p. 278; see also 1936: 20.

Yonge, C.M., "Form and habit in *Pinna carnea* Gmelin," illustrations, pp. 338, 350, 363, etc.

The Greek Connection: What Aristotle Probably Did Not Say

As with so much else in our conception of the natural world, the pedigree of *Pinna* goes back to Aristotle (384-322 BC). And, because Aristotle partook freely of whatever his predecessors and contemporaries had put on record, we find wild notions lying as unannounced bed-fellows alongside what may have been Aristotle's own observations.

Pinna was well-known to Aristotle, as it obviously had been to the sea-oriented Greeks from times long gone. Whether one ought to believe his pleasant story that a *Pinna* and its *Pinna-guard*, a small

crab, are inseparable companions, is moot. They are often found together, anyway. One is justified in raising an eyebrow in regard to his claim that they were somehow generated together. Nor were *Pinna* and its kind, as he stoutly maintained, produced spontaneously from the mud of the shore.

Sometimes, Aristotle's ignorance is understandable. The roles, so evident to us today, of mass-production of tiny eggs and larvae by shellfish and the ever-recurring pulse of the tide as a distributor of microscopic fry were not then known. No naturalist today, however, would agree with his conclusion that such unlike creatures as skates and angler-fishes were able to mate and produce intermediate species.

But, in the matter of *Pinna*, Aristotle's chief mischief, probably entirely unintentional on his part, was to introduce a new use for an old word. He knew well enough that *Pinna* spent its life fastened to the sea-bottom by what I have already been forced to call, in order to be intelligible to fellow naturalists, its byssus. Such a use of the word, however, flies contrary to a considerable body of history. It seems certain that its current usage would have made no sense to Aristotle.

The misuse of this word, as the name of *Pinna*'s anchoring beard, is relatively recent, however firmly it has overturned two thousand years of history. Classicists have not been happy. But ... byssus it has become, until today even textile experts may uncritically equate 'byssus' and 'byssine' with *Pinna*'s Sea-silk only.

What happened? Only a part of the long story will be told here and my text is overwhelmingly indebted to an excellent paper on this malaprop word by P.J. van der Feen.

A Greek dictionary, van der Feen writes, has two meanings for what can be transliterated as *bussos*. [1] *Bussos* (or sometimes *Buthos*), masculine, means the depth of the sea or of a river. [2] *Bussos*, feminine, is a fine fiber of vegetable origin that was anciently woven into highly valued textiles.

While some may quibble over Aristotle's description of *Pinna* in his *Historia Animalia*, van der Feen seems fairly to translate it: "The

Pinna-mussels grow upright out of the depth, in sandy and muddy places." Aristotle thought of Pinna's beard as a *root*. Whether he thought, as Busbecq and Buonanni did, of it as an organ for securing sustenance, is not clear; since he thought that Pinna and its crab fed on little fishes, perhaps he thought it unnecessary to attribute a root-like nutritive function to it. In any case, he could not have been farther from the mark than the English traveler Henry Swinburne (1790), who adorned his book with a list of shells – but proved his lack of ability to observe closely by alleging that Pinna attached itself to a rock by its hinge, while its silky beard was thrown out on the ventral side to lure small fishes into the mantle cavity to use as food.

Anyway, as the great Swiss polymath, Konrad Gessner, astutely put it (as translated by van der Feen): "... I would rather say that the hair-tuft grows from Pinna than Pinna from the hair-tuft."

The trouble seems to have gone back to Theodorus Gaza (a wandering Greek scholar, born 1398). Using a manuscript copy of Aristotle that may have been faulty, Gaza made Aristotle say: "... Pinna-mussels grow (come forth) upright from the byssus ..." (van der Feen translation). This view was soon adopted by the pioneering mollusk taxonomist Guillaume Rondelet. Rondelet's authority became such that the subversion was quickly accepted in zoological circles. The spread of the misunderstanding from biology to fibers and textiles was uncalled for and ultimately produced a mish-mash that today badly needs to be clarified.

Part of the problem is that textile experts today look only to their dictionaries or encyclopedias for guidance. Another part is allied to the fact that few biologists today are classicists. However, it must also be noted that so excellent a scholar as D'Arcy Wentworth Thompson, in his translation of Aristotle in 1910, tended, with some misgivings, to accept Gaza's reading.

A later chapter will consider further the tangled history of the word byssus.

References

Aristotle, in *Historia Animalia* (Peck's transl., 1: 35), claimed "to discover the causes ... only after we have before us the ascertained facts about each item." Some of his reports, obviously gathered from accounts of others, indicate how far he wandered from that narrow path. In his *Generation of Animals* (Peck transl., p. 365), Aristotle writes of animals that are generated spontaneously, citing as a fact "that all the Testacea take shape spontaneously." Nor do shellfish produce eggs or other propagules, "their 'eggs,' as they are called ... contribute nothing to generation; they are just a sign of good nourishment, like fat in blooded animals, and that too is why they are tasty to eat at these seasons" (Peck, p. 367). Aristotle's other statements may be found in Thompson's translation (1910, quoted here with scholarly pagination): Pinna shells are rough and do not have ribs (ridges, as in scallops)(528a. 20, 25). Pinnae "are incapable of motion and are attached fast to some external object" (528a. 30). Thompson rather hedges, as his footnote 1 explains, in his translation of the following: "The pinna grows straight up from its tuft of anchoring fibres in sandy and slimy places" (547b. 15). See also Gaza. In an effort to explain differences among plants and animals, Aristotle puzzled over animals that "are fairly rooted, and in several cases perish if detached; thus the pinna is rooted to a particular spot ..." (588b. 10, 15); thus, he knew about what we call the byssus, by which Pinna is 'rooted' to its chosen place: but he did not call it that.

Buonanni, Filippo, *Ricreatione dell'Occhio e della Mente nell'Osseurvation' della Chiocciolle*, p. 157; while that learned Jesuit thought clearly about mollusks and their classification, he held fast to certain anachronistic notions, particularly those dear to Aristotle concerning spontaneous generation.

Busbecq, O.G. de, see previous chapter.

Feen, P.J. van der, "Byssus," has been quoted liberally; this work bears further study by anyone interested in an intriguing question.

Gaza, Theodorus, his transl. of Aristotle's *De Natura Animalium*, Venice, 1476; quoted by van der Feen.

Gessner, Konrad, *Historiae Animalium De Piscium et Aquatiliu Natura*, 4: 864; van der Feen's translation is quoted.

Rondelet, Guillaume, *Universae Aquatiliu Historiae, Libri de Piscibus Marinis*; 2: 51; quoted from van der Feen's translation; to atone for his sin

in regard to byssus as the name of a part of Pinna, he added an account of the classical byssus, pp. 54-55.

Swinburne. Henry, vol. *Travels in the Two Sicilies*, 1: 77-79.

Thompson, D'Arcy Wentworth, his transl. of Aristotle's *Historia Animalium*, Book V.15.547; *A Glossary of Greek Fishes*, pp. 200-201, 1947, provides a learned history of Pinna, with an uncompromising sample of classic authors, some of whom can only with the greatest good luck be found translated, in part or whole, into English.

What About Jason And His Golden Fleece?

Some subjects in any essay require more space for their denial than for their affirmation. That, it seems to me, is the case with statements that Pinna's Sea-silk produced a textile that Jason and his Argonauts sought in their pursuit of the Golden Fleece.

In the first place, references to this matter are hardly ever more than allusions, dubbed into popular accounts to spice up what is otherwise a story soon told. Thus, R. Tucker Abbott wrote in his account of *Pinna*: "Some historians have suggested that the Golden Fleece, sought by the legendary Greek Jason, was a piece of cloth made from *Pinna* silk." Here, Abbott but echoes A. Hyatt Verrill: "Of course, it is very costly, perhaps the most expensive of all textiles, and many historians claim that the golden fleece that lured Jason on his adventurous quest was in reality cloth made from the byssus of the *Pinna* shell."

'It is said ...' – and on it goes, much the same being written by authors of popular articles Marco Suraci and Olga Osing. The latter enlarges a bit: "This sea silk has a long history. It is believed that its use in making garments originated in Colchis, an ancient kingdom on the shores of the Black Sea."

"Since Colchis was the name of the Golden Fleece sought by Jason and his Argonauts in the Greek legend, it is believed by many historians that the Golden Fleece and byssus cloth were identical."

'Many historians ...'! Maybe so: no account names any of them. As for Osing, I should also like to know the origin of her idea that

the making of textiles from Sea-silk began in Colchis. Some sort of silkworm silk cloth, maybe? Silk traded over the Great Silk Roads that led across the width of Asia to China? Could it not have been woven cloth that incorporated metallic gold? Surely, pure gold would be more likely to excite the interest of a Greek adventurer than even cloth of silkworm silk – much less cloth made by a mollusk that was as common in Jason's home seas as anywhere in the world.

Perhaps the best denial of substance to the claim that Sea-silk was involved in the history of Jason's voyage is to be found in Janet Ruth Bacon's excellent history of *The Voyage of the Argonauts*. It was, Bacon writes, the growth of a legend over a period of centuries that ultimately gave us the account that we today deem the full story. It began with the history of a real voyage, made by anonymous Greeks in the late 14th or early 13th century BC. "This feat ... became very soon embellished with many of the stock incidents of fairy tales about quests and journeys."

How familiar it sounds! While documents relating to the Homeric age mention the story, there is nowhere in them a reference to a fleece. Over the years, there were added accounts of a fairy king's daughters, minor goddesses, other journeys. Then, some phases of the end of human sacrifice and the substitution of a ram are encountered. About 630 B.C., there is mention of a fleece of a ram, which only later "became golden by association with the gold of Colchis." All this came long after the time of Homeric writers.

Later figures were gradually added to the crew, details from later explorations were encrusted, allusions to religious rites were intertwined – even tales of romantic love – and it was not until the fifth century BC that we have the story essentially as now known.

I think we have here an example of what Hilda Ecsedy calls "folk-etymology": quite unrelated meanings and definitions and explanations, often entirely out of phase historically, are gradually welded into a new whole, with one word, often old but given an entirely new meaning, made to stand for the emergent concept. Thus, in the history of Ecsedy's word "Böz," you get clues from many centuries of borrowing and barter – a "sea sheep," true 'byssos' (whatever that

might be, but of vegetable origin), what she calls *pinikon*, which is made of Sea-silk – “and the final touch to the story ... added by borrowing a few details from the legendary cycle of Argonauts about the mythological ‘Golden Fleece.’ ”

Negative evidence, even when used against published claims that are utterly insubstantial, has a hard time gaining credence. Yet, I am deeply skeptical of assigning any weight to notions that Jason’s Golden Fleece was made of Sea-silk. My bias has been enhanced by reading a recent work of grand scholarship by Elizabeth J.W. Barber, on the history of cloth in the Neolithic and Bronze Ages, especially in the region of the Aegean Sea. Surely, I thought, if Sea-silk were to be found in use at an early date, it would have been in that region.

Furthermore, Barber’s survey is much more far-reaching than the book’s title implies: you put it down with the feeling that if there were early examples of Sea-silk, they would be found among all the great many records of true silks and other fabrics that have, indeed, survived. (Thus, it cannot be simply a matter of fragility or proneness to damage by moths or degradation by agencies of organic breakdown that explains the absence of records of Sea-silk.) And, in a letter to me, Barber says that she found *no* evidence of Sea-silk in any fabric dated prior to 400 BC (her cut-off date) – indeed, “in many travels through museum collections,” she saw nothing “that looked like anything other than bast [that is, linen or a similar plant fiber] or wool.” Such a conclusion fits in well with current notions that the earliest references to Sea-silk in the Western world are about 100 or 200 AD. – a far cry from the Homeric, or even the Neo-Homeric, world.

There are a couple of items that deserve attention, even though they come from worlds that are poles apart. There is an odd account in an old English version of the *Hortus Sanitatis* that I quote in full in a later chapter on the Age of Bestiaries. It refers to a splendid wool produced by a strange marine creature that was “founde in the tyme of the warre betwene the troyans and the grekes.” St Albert’s translator, in a modern version of *De Animalibus*, takes this to be a confused reference to Pinna.

Or ... is this but a version of the Water-sheep that we shall later treat? A golden fleece of ancient lineage, in any event!

And there is the more serious allusion by the great Sinologist, Paul Pelliot. Even though he left but the slightest hint, it is worthy of notice.

Pelliot wrote, in his elaborately involved account of the history of cotton in Asia, that he felt it necessary to suggest that, “in the ‘earth-born lamb’ located north of Ta-ch’in [which one may perhaps think of as Syria] and the armoured men who strove to seize it, we may hear a faint echo of the story of the Argonauts and the Golden Fleece.”

References

Abbott, R. Tucker, *Kingdom of the Seashell*, p. 184.

Albertus Magnus, *Albert the Great / Man and the Beasts / De Animalibus* (1987), p. 332; the Trojan history refers to an alleged pre-Homeric account by Dares Phrygius.

Bacon, Janet Ruth. *The Voyage of the Argonauts*; note especially the lovely maps, tabulations of evidence, pp. 35-35, “The Growth of a Legend,” pp. 168-169.

Barber, Elizabeth J.W., *Prehistoric Textiles*; also letter from her, 1 Jan. 1994.

Ecsedy, Hilda, “Böz,” pp. 150-151.

Hortus Sanitatis, described by Noel Hudson, p. 128.

Osing, Olga, “Silk from the sea.”

Pelliot, Paul, *Notes on Marco Polo*, vol. 1, p. 531.

Suraci, Marco, “Le conchiglie produttrici della preziosa ‘Lana penna.’ ”

Verrill, A. Hyatt, *Shell Collector’s Handbook*, p. 77.

Pinna And The Pinna-Guard In Greece, Rome And Hellenistic Egypt, Through The Time Of Pliny

This chapter concerns a sea-oriented world where Pinna was a natural object minutely, if mythically, attended to by common repute. It was also a world that, as far as I can see, had no thought of Pinna as a producer of a potentially useful – much less highly desirable – fiber to be used for weaving into textiles.

Aristotle's observations and thoughts on Pinna are soon summarized. With an overwhelming world of facts to be gathered and organized and, further, a world constantly bombarded by disconcerting new information from barbarian lands, Aristotle can be excused for saying so little about Pinna and her associates.

Pinna, Aristotle said, was an animal that lived rooted in the bottom of shallow Mediterranean seas. Each Pinna seemed to have its Guard, Pinnoterres to the Greeks or Pinnophylax to later Romans, either a pea-sized crab or a tiny shrimp, or both. Pinna and its helper were widely accounted to arise together and report had it that neither could live without the other. With hardly a second thought, Aristotle hurriedly said it was so. It took biologists many centuries to return to raw nature and put a dent in Aristotle's picture.

The story deserves retelling. You may learn of Pinna and her kind in D'Arcy Wentworth Thompson's account of Greek "fishes." George Sarton has alluded to the status of ecology in Aristotle's time. Good modern accounts of the crab *Pinnoterres* (sometimes spelled *Pinnotheres*) may be found in L.A. Stauber and A.M. Christensen and J.J. McDermott; for a brief reference to both crab and shrimp, *Pontonia*, see an old classic by T.R.R. Stebbing.

Anyway, Pinna's repute went beyond Aristotle. People in many walks of life knew of Pinna and Pinna-guard and used their imagery in one way or another in their lives.

Isidorus Characenus, in the first century BC, left an account of the overland trade route to India. In it, he had occasion to relate the tale of Pinna and Pinna-guard, but implicated the pearl oyster instead of Pinna.

Pinna and Pinna-guard furnished Cicero (104-32 BC) with notions of natural morality. In *De Finibus Bonorum et Malorum*, he contended that, "... just as some of the parts of the body ... are created as it were for their own sakes, while others ... also subserve the utility of the rest of the members, so some very large animals are born for themselves alone; whereas the sea-pen [Pinna] ... in its roomy shell, and the creature named the "pinoterres" because it keeps guard over the sea-pen, which swims out of the sea-pen's shell, then retires back into it and is shut up inside, thus appearing to have warned its host to be on its guard – these creatures ... do certain actions for the sake of others besides themselves." (The core of the argument here is, of course, that Pinna is blind and its helper sighted.) Then, in *On the Nature of the Gods* (or *De Natura Deorum*), Cicero wrote further: "The mussel (whose Greek name is *pina*) and the little shrimp [read 'crab,' in this case] have formed a mutual compact, with sufficient nourishment for each as the object: the mussel lies with its two large shells open, and when tiny fish swim into the aperture, the shrimp nips the mussel, which closes its shells; thus food is provided for both these utterly dissimilar creatures."

All this is part of a somewhat general teleological belief among many Greeks, as pointed out by A.S. Pease.

That the relationship between Pinna and Guard was uniformly mutually beneficial probably was doubted by some early on. The argument has gone on for many years, sometimes with the stated intention of proving Aristotle a poor observer. Nowadays, there is general agreement that there is indeed commensalism but probably very little mutualism, with some decided feelings that the crab is a parasite of living space, if not more.

Some measure of early skepticism about the benefits of the crab may be inferred from the reference by Aristophanes (c. 450-c. 388 BC) in "The Wasps," where his 'Pinoterres' is a small, bungling man, a kind of social parasite. This is still proof enough that the story was well-known among the playwright's audience.

Theophrastus (c. 370-285 BC), a contemporary of Aristotle, was a bit ambiguous as to who gained in the relationship. In *De Causis*

Plantarum, he suggested that "... there are animals that are only found in other animals, like those in the Pinnae ..." – hinting at a lop-sided relationship; but elsewhere he supposes that advantages may be mutual, "For there would perhaps have been no life for the pinnae either but for the crab"

Chrysippus the Stoic (c. 280-206 BC) was said by Athenaeus to have commented upon such matters as these concerning Pinna and crab.

There is reference to Pinna and its guest in a Greek proverb quoted by Michael Apostolios (fl. 1462, d. 1480?) in Leutsch and Schneidewin; but I do not know what era of Greek history he referred to and I have not seen either English or Latin translations.

Although dates cannot be set, for another indication that the story of Pinna and Guard were common knowledge, there is the contribution by Artemidorus Daldianus (ca. 100 BC) in *The Interpretation of Dreams*. To dream of fish that slough off their old shells is "a good sign for those who are sick, for prisoners, for poor men, and for all those who are in a difficult situation. For they will cast off the sorrows that surround them." Similarly, "The pinna and the so-called pinna-guard are good [to dream about] for marriages and partnerships because of their own partnership and the good will that they bear towards one another."

Somewhat similar material on Pinna and crab is to be found in a work maintaining that animals have reason, by Philo (Philonis Judaeus of Alexandria)(c. 30 BC - c. 40 AD), as reported by Georg Tappe.

For reasons not entirely clear and with the usual disclaimer that misidentifications may have been made, it appears that early Greek city-states occasionally figured both Pinna and Pinna-guard (or, certainly, crabs of some sort) on their coins. These go well back into antiquity. The zoological historian, Otto Keller, identified both creatures on certain coins in the collection of Friedrich Imhoff-Blumer. One is an 'Elektronstater' from Cyzicus and shows an oversized Pinna-guard with a Pinna in its claws, with a fish below, said to be the Mediterranean tunny. Another coin, of a similar denomination, from Cyzicus shows a Pinna and a tunny. A bronze coin from

Gyrneion in Aeolis, on the west coast of Asia Minor, showed Pinna on its reverse. In addition, the collection contained carved gems that Keller thought depicted a Pinna-guard (a carnelian and a replica of a gem in a Berlin museum).

Kurt Ludwig Regling illustrated similar coins: an 'Elektronstater' from Cyzicus, dated between 700 and 480 BC (Pinna?); a similar coin, dated between 570 and 520 BC (Pinna and crab); and a coin of Kos, with the latter date (crab only). Paul Naster listed and illustrated a coin from Cyzicus; it shows two Pinnas superposed (crossed), above a tunny.

As to the motive for showing Pinna and crab (or either alone), I can only guess. Perhaps their appearance together stemmed from their popular repute as omens of good luck or partnership. Students of coins seem to have been loath to speculate. Charles Theodore Seltman has written about coins of the Greek state of Cumae in Italy (about 500-423 BC) that showed "That city's coat-of-arms ... a mussel shell, one of the natural products of a district where shell-fish thrive in the salt lakes of Avernus and Lucrinus." Whether this reference is to Pinna is not certain, although two coins illustrated show a mussel of some sort, one a mussel held between the claws of a crab.

As for statuary showing Pinna, there is little evidence for it. Gisela M.A. Richter made not the slightest reference to the matter; she certainly knew of the identifications in Imhoff-Blumer and Keller. Jocelyn Toynbee reported no use of Pinna in Roman art. Yet, H.B. Walters referred to two undated Greek bronzes in the British Museum that appeared to him or his informants to show representations of Pinna mussels. One was a "grotesque figure, seated. ... he is nude and beardless, and wears a cap; in both hands he holds a *pinna* or conch-shell, which he is blowing." This is a dubious reference to Pinna: one can readily blow a blast on a properly prepared conch but I can think of no way that you could produce a sound on a shell of the Pinna sort – aside from the fact that the two shells are too dissimilar to be confused. The other figures show the upper part of a diver: one "has Ethiopian ... features ...; his hands are extended, clasping a *pinna*, which he has just brought up." The second diver

is rather similar.

As for Pinna as an item of interest other than furnishing a sermon for the pious, its use as food comes to mind as a most likely focus. There seems no question that Pinna can be eaten but the ancient Greek world is pretty much mum on whether they were often so used. Athenaeus quotes the late Greek comedy writer Diphilus (late 4th century, early 3rd century BC) with recording that "Pinnae are diuretic and filling, but hard to digest and assimilate." There are comments upon their use as food in the later Roman world and this will be treated later. Maybe early Greeks had no need to find tasty ways to prepare a shell-fish that they thought of otherwise as a second-rate food.

Nicander (fl. 150 BC) mentions, in his 'Alexipharmaca,' various foods that the diner (or is it properly 'patient'?) may eat: "some of these he should devour raw, others boiled, many of them after broiling over a fire; but dishes of *Sea-Snails* or of the *Purple Limpet*, of *Crayfish* and *Pinna* and of the brown *Sea-Urchin* will be far more helpful ..." – the implication being in the latter case, I think, that they ought to be served as parts of more elaborate dishes.

On the doorstep to Pliny, whose story will be told shortly, we have Xenocrates the Physician, of Aphrodisias in Cilicia (who lived perhaps the middle of the first century A.D.). In a book dealing mostly with food, he mentioned Pinna and the crab; but I suspect it was more general natural lore than a recipe for these 'fishes' as food.

Apicius, the epicure (fl. 14-37 AD), was not only late, he was entirely negative as far as I can see. True enough, he told how to cook a gourmet's meal using a Perna, a ham (one of the common Roman names for Pinna – because of the general ham-like shape: see also a French common name, *jambonneau*, 'little ham'). But it was, indeed, only a ham that Apicius had in mind.

The second great synthesizer of natural history after Aristotle was Caius Plinius Secundus (23-79 AD), known to the modern world as Pliny the Elder. He died in the destruction of Pompeii by the eruptions of Mt. Vesuvius. In his lifetime, he brought together an

enormous library and gathered lore from every corner of the world known to his far-reaching mind. Despite charges that he was uncritical, his work had the merit of preserving at least some parts of ancient wisdom and lore that would otherwise now be lost.

Pliny's comments on Pinna (and, more or less incidentally, the crab) pretty much parallel those of Aristotle. Again, there is no hint of exploitation of Pinna for its Sea-silk; this is highly significant, for Pliny's interest in natural fibers was comprehensive and deep.

Pliny's account of Pinna and crab is replete with the certainties we have met before: "It occurs in marshy places, always in an upright position, and never without a companion which is called the pea-crab, or by others the sea-pen-protector: this is a small shrimp, elsewhere called a crab, its attendant at the feast. The sea-pen [Pinna] opens, presenting the dark inside of its body to the tiny fishes; these at once dart forward, and when their courage has grown by license, they fill up the sea-pen. Her marker having watched for this moment gives her a signal with a gentle nip. She by shutting up kills whatever she has enclosed, and bestows a share on her partner."

While others have held the octopus to be a mortal enemy of Pinna, Pliny does not mention Pinna by name in his account of that creature. His *polyp* (clearly an octopus of some sort) loves to eat shellfish; but, knowing that the shellfish may close tightly and nip off its tentacles, waits for the shellfish to open, then cleverly places a stone between the shells so they do not close and feeds on the shellfish's flesh through the gap. The sometimes reported claim that the crab, pinnoteres, may warn Pinna of the approaching octopus and then, in a flash, retire to the safety of Pinna's mantle, is not retold here. Frank W. Lane's account of shellfishes and octopuses is worth reading.

Pliny's animals may be studied in commentaries by Jules Cotte, Otto Keller and D'Arcy Wentworth Thompson.

It would be thought that Pinna and Pinna-guard ought to appear in the many marine representation found on murals of the city ruined by Vesuvius. Perhaps a proper study has not been made of the evidence.

N. Tiberi knew of Pinna's presence in the local fauna but found no evidence of a representation of it in the murals, etc. I think a "Still life with trampoliere," reproduced in a book on Pompeii by Trewin Copplestone, possibly shows two Pinna shells.

It remains to pull together a number of more or less negative reports, some of which have to be denied because of undoubted faulty attributions.

Lexicographer Henri Estienne (Henricus Stephanus) did not find any mention of Pinna in regard to fibers and fabrics in the entire Greek world. R.J. Forbes's summary history of ancient technology has no record of the use of Sea-silk. Interestingly, Biblical natural history, treated by H.B. Tristram, does not touch upon Pinna in any way.

There is no reason whatever to credit Liddell and Scott's notion that the reference by Menander of Athens (342-293 BC), in his reference in "The Arbitrants," to "Silken Tarentine" was to a diaphanous fabric made of Sea-silk. Nicostratus Comicus, possibly a son of Aristophanes, in the 4th century BC, alluded to a diaphanous cloak of Tarantine, as noted by John M. Edmonds. Again, there is no reason to think that it was made of Sea-silk. The same applies to the moralizing of Seneca (ca. 45 BC - 65 AD) and his denunciation of feminine folly: "I see there raiments of silk - if that can be called raiment, which provides nothing that could possibly afford protection for the body, or indeed modesty, so that, when a woman wears it, she can scarcely, with a clear conscience, swear that she is not naked." However nice it would be to believe that that was a fabric of Sea-silk, I am sure that the silk he ranted against was silkworm silk, brought to his world from China (not even one of the wild silks, described by Aristotle as coming from the island of Cos, as recounted by William T.M. Forbes).

Dr. Norman Indictor will report elsewhere upon an archaeological textile of the 1st century A.D. that was thought possibly to be Sea-silk; it turns out, upon chemical analysis, to be silkworm silk.

References

Apicius, *The Roman Cookery Book*, transl. by Barbara Flower and Elisabeth Rosenbaum, pp. 167, 169.

Aristophanes, "The Wasps," lines 1510-1511.

Aristotle, *Historia Animalium*; see the Thompson translation, Bk. IV, 528a, 20, 25, 30; Bk. V, 547b, 15 (and footnote), 25, 548a, 25; Bk. VIII, 588b, 15.

Artemidorus Daldianus, *The Interpretation of Dreams / Oneirocritica*, Bk. 2, p. 99, note 63, pp. 145-146.

Athenaeus, *The Deipnosophists*, 3: 89c-d, a reference to a lost work of Chrysippus.

British Museum, Department of Coins and Medals; Department of Greek and Roman Antiquities; various letters and photographs.

Christensen, A.M., and J.J. McDermott, "Life history and biology of the oyster crab."

Cicero, Marcus Tullius, *De Finibus Bonorum et Malorum*, 282-285; *De Natura Deorum*, 274; see also the edition of *De Nat. Deo.* by A.S. Pease, 862-863, notes.

Copplestone, Trewin, ed., *Pompeian Frescoes*, pl. 11.

Cotte, Jules, *Poissons et Animaux Aquatiques au Temps de Plin.*

Cratinus, Comicus (J.W. Edmonds, ed.); see Athenaeus, 3: 86e; a vague reference to supposed edibility of Pinna.

Edmonds, John Maxwell, *The Fragments of Attic Comedy*, 2: 43.

Estienne, Henri; his thesaurus of the Greek language, annotated reference on *Pinna* and related matters, vol. 7, col. 1095.

Forbes, R.J., *Studies in Ancient Technology*.

Forbes, William T.M., "The Silkworm of Aristotle," an interesting account of what Aristotle probably understood by the use of words now translated as 'silkworm' and 'silk.'

Ideler, Julius Ludwig, material from a minor Greek work, *Anonymi de Alimentis*, II, 269; Greek only, with reference to Athenaeus, III, 91e.

Imhoof-Blumer, Friedrich, and Otto Keller, zoological comments on a collection of coins and carved gems owned by the senior author, with illustrations, pp. 45, 53, 146, pls. VII, 8, 10; VIII, 41; XXIV, 25, 27, 1889.

Indictor, Norman, letter 3 March 1993.

Isidorus Characenus, *Parthian Stations*, p. 11.

Keller, Otto. *Die Antike Tierwelt*, vol. 2: 488-489, 495, 549-550.

Lane, Frank W., *Kingdom of the Octopus*, see especially pp. 79-80; much of interest throughout.

Leutsch, E.L., and F.G. Schneidewin, *Corpus Paroemiographorum Graecorum*, II, 472-473, a passage from Apostolius.

Liddell, Henry George, and Robert Scott, *Greek-English Lexicon*, Pinna, p. 1405.

Menander, of Athens, *The Principal Fragments*, line 272, a reference to either true silk or a local product of Taranto, not Pinna's Sea-silk.

Naster, Paul, coin collection of Lucien de Hirsch; one coin shows alleged superposed (crossed) Pinnae with a tunny – item 1444, a coin of Cyzicus, 600-550 BC; illustrated, pl. LXXVI.

Nicaner, *The Poems and Poetical Fragments*, p. 121.

Pease, Arthur Stanley, "Caeli Enarrant," p. 177, note.

Pliny, *Natural History*, Rackham's pagination used, III, 259; VIII, 557, 561; see index, pp. 592, 593.

Regling, Kurt Ludwig, *Die Antike Munze*, pp. 124-125.

Richter Gisela M.A., *Animals in Greek Sculpture*.

Sarton, George, *A History of Science*, vol. 1: 565-566.

Seltman, Charles Theodore, *Greek Coins*, p. 122, pl. XXI.

Seneca, Lucius Annaeus, *Moral Essays*, vol. 3, 479.

Stauber, Leslie A., "Pinnotheres ostreum," good illustrations, pl. I, p. 271.

Stebbing, Thomas R.R., *A History of Crustacea*, pp. 99-ff., 241-242.

Tappe, Georg, *De Philonis Libro qui Inscritur Quaestiones Selectae* (on Alexander, or that Dumb Animals Have Reason), pp. 19-20; this is a Latin translation of the original surviving manuscript in Armenian.

Theophrastus, *De Causis Plantarum*, vol. I, pp. 345, 347.

Thompson, D'Arcy Wentworth, *A Glossary of Greek Fishes*, Pinna is treated pp. 201-202; Pinnotheres, p. 202; much of interest throughout.

Tiberi, N., "Le conchiglie Pompeiane."

Toynbee, Jocelyn M.C., *Animals in Roman Life and Art*.

Tristram, H.B., *The Natural History of the Bible*.

Walters, H.B., *Catalogue of the Bronzes ...*, pp. 268, 269, nos. 1673, 1674, 1675.

Xenocrates, the Physician, of Aphrodisias, in *Physici et Medici Graeci Minores* ed. by J.L. Ideler, vol. II, p. 129.

Adventures On The Erythrean Sea: The Question Of Sea-Silk In India

This chapter is something of an exercise in futility. The byssus-bearing mussel, genus *Pinna*, is abundantly represented in India. There has long been a Western interest in Indian textiles: early on, those made of cotton, a rare luxury in the early Western world; latterly, textiles made of silk, when culture of the Chinese silkworm spread to India. Many were textiles of marvellous fineness, obviously a major interest to the vanities of the West. Pinna mussels also produce pearls, although generally held to be of poor quality. A few authors have maintained (perhaps dubiously, for the Indian pearl of commerce was no doubt produced by the vast beds of pearl oysters, genus *Meleagrina*) that there was an early Indian trade in such pearls: why not diaphanous textiles made of Pinna's Sea-silk as well?

While the notion of vague Indian connections for some aspects of Pinna's history have a considerable circulation, the major part of the story begins with a lapsed Unitarian minister of great classical learning and erudition, James Yates (1789-1871) (see Gordon's biography). In 1843, he published *Texturum Antiquorum: An Account of the Art of Weaving Among the Ancients*.

Yates was impressed by several facts. In contrast to the abundant references to Pinna in general, back to the time of Aristotle, allusions to articles made of Sea-silk dated only to the early part of the Christian Era. The earliest known to him (as to us: this will be treated in a later chapter) was by the great early Christian scholar, Tertullian (c. 155 - after 220 AD). Further, Yates felt that, after a series of early references to it, reports of Sea-silk declined; then, at some point in the 1700s, it seemed that the industry again suddenly sprang into prominence in the region of Taranto in Italy. It was there, Yates pointed out, an industry based largely if not entirely upon knitting, a technique unknown to makers of textiles in all early centuries of the Christian Era.

Yates's conclusion was that not only was the weaving of cloth from Sea-silk not known in the Christian-Pagan West until the time of Tertullian: there was no proof that it was at that time in any way identified with the region of Taranto. Later commentators, he maintained, put its origin at Taranto because the eighteenth century's industry was so largely centered there. Being unwilling to believe that the weaving of a fabric as rich as that implied by Tertullian and others could have been so quickly perfected, after its entire absence in earlier Classical Antiquity, Yates felt that you had to search elsewhere for its land of origin. His conclusion was that "fine cloths of this substance were made in India, and thence imported into Greece and other countries."

It is too cynical to sneer that if you cannot place the origin of a process with precision, you are safest to put it in a country beyond ordinary processes of historical recall.

True enough, Yates had little to go on. His thesis went back, as Yates saw it, to an anonymous Greek guidebook to trade and travel in the vaguely known seas to the eastward of the Horn of Africa. The book in English is entitled *The Periplus of the Erythraean Sea*. Its author has been variously attributed. It is dated, according to David W. Macdowall, to about AD 120-130.

Unhappily, the ground is shaky. Yates insisted, following certain authorities, that one particularly defective section required emenda-

tion. Knowing his classics thoroughly, Yates took this emendation, that guess, suppressed one version, substituted another – all thoroughly annotated! – and came up with an answer. That done, he produced terms that meant, he said, Pinna and Sea-silk. Others make the terms to mean pearl-oysters and pearls (or a cloth decorated with drilled seed-pearls). For Yates, the passage became "fine cloth obtained from shells which yielded pearls," among which Pinna, of course, is included. Since Pinna mussels, with their great tufts of Sea-silk were "no less abundant in the Indian than in the Mediterranean Sea," Yates concluded that the 'Periplus,' despite the corrupted state of the text, provided "a sufficient proof, that this beautiful substance was spun and woven by the Indians, whereas we can only suppose from analogy that the manufacture was carried on in ancient times by the Tarentines."

How about the evidence in the 'Periplus'? Unhappily, for all its charm, it is evanescent and seems to evaporate all the faster the closer you look. It is a battle that must be fought out in footnoted references by philologists.

Basically, the reference is to Section 59 of the 'Periplus,' although one naturally checks out the same words elsewhere in the narrative. The outsider may well have a queasy feeling that Yates was on to something.

William Vincent (1800) translated the short paragraph thus: "The first place that succeeds after leaving Kolkhi, is the Bay Argalus, connected with a district inland [of the same name]. Here, and here only, all the pearls obtained in the fishery at the island of Epidorus are [allowed to be] perforated [and prepared for market]. Here also are to be purchased the fine muslins called Ebargeitides." Even with the square-bracketed emendations, there was elaborate footnoting.

Shortly afterward, Vincent saw fit to change his mind about this (1814 or 1815) and cited the about-face of an early commentator on all this, later cited by Yates, which seemed to indicate that a shellfish that produced a woven fabric was involved. In his correction, Vincent made a mistake, taking the pearl-oyster rather than Pinna for the producer of the fiber that was woven. The pearl-oyster does

have byssus fibers but they are coarse and sparse. This mistake was carefully pointed out by John Stackhouse, as reported by Richard Polwhele. Note, however, proof that there is a byssus-bearing Pinna in Indian seas is not proof that it was ever used there to make a fabric.

McCrindle's 'Periplus' has it: "A pearl fishery ... in the neighbourhood of Kolkhoi, in the kingdom of Pandion, near the island of Epiodoros; the produce transported to Argalou, in the interior of the country, where muslin robes with pearl interwoven ... were fabricated."

Huntingford's version is: "From Komarei the country extends toward Kolkhoi, where diving for pearls is carried on ... the work being done by convicts. It is in the kingdom of Pandion. After Kolkhoi comes a Coast-land ... lying round a bay, with an inland region called Argalou. In one place here are brought pearls ... collected in this richly endowed land. The muslins called Argaritid ... are exported from here." However, he insists that the passage is so corrupt and "such a mess that any translation is little more than guess-work."

Casson's version reads: "Beyond Komar the region extends as far as Kolchoi, where diving for pearls goes on; it is carried out by convicts. The region is under King Pandion. After Kolchoi ... [his symbol] comes the Strand, bordering a bay with, inland, a region named Argaru. In one place ... [his symbol] along it ... [his symbol] pearls are gathered. It exports the cotton garments called Argaritides."

In no modern version can you see much evidence of Pinna and Sea-silk. The Greek word that transliterates to 'pinikon' is translated by present-day authors as pearl (etc.), rather than anything to do with Pinna, a point on which early authors had put their faith. Some fine points will be cited in notations in the References but it suffices perhaps to quote here a great modern authority on the 'Periplus,' Giuseppe Giangrande: "I am afraid that the passage in the *Periplus* ... is too corrupt to allow any persuasive hypothesis: Yates' suggestions are based upon conjectural alterations of the admittedly corrupt text, and are therefore not strong enough for any argumentation to be based upon them."

For all that, various historians, some with zoological aptitudes, some not, have tended to accept Yates's conclusion. Others have cited it tentatively, some with definite suspicion. Blümner thought the original text unclear. Edmond Saglio's article on "Pinna" (Daremberg and Saglio) cited, without comment, Yates and an early student of the 'Periplus' who was most favorable to the theory. Berthold Laufer treated the theory with sympathy but expressed reservations. Karl Joachim Marquardt reviewed the early Roman literature and thought the passage in the 'Periplus' of dubious value. Mommsen and Blümner's perceptive account of probable Sea-silk in the price-fixing edict of the Roman emperor Diocletian cites the passage in the 'Periplus' with some agreement. Joseph Needham was thoroughly in agreement with Yates's thesis. Franz Passow's Greek dictionary goes into shades of meanings of words related to shells, pearls and the like and one might build a case for Yates's notion. Hans Rommel, in Pauly and Wissowa's *Realencyclopädia*, was skeptical, while M.-Th. Schmitter seems generally favorable, after a searching review of European and Middle Eastern literature. Zoologists Ruth D. Turner and Joseph Rosewater appear to have accepted the notion of various Indo-European connections. Historian E.H. Warmington's fine history of commerce between the Roman Empire and India found little merit in Yates's thesis.

Thus, you pay your money and choose your horse. Can anything be learned by means of other approaches? Four general subjects come to mind: the pearl fisheries, Indian expertise in spinning and weaving diaphanous muslins (of cotton), what might be called Indian folklore and the accounts of travelers in regard to the Indian Pinna mussel and its byssus. I report in turn upon clues offered by these approaches.

That there are fabulous pearl fisheries in Indian waters (especially on the southeastern coast between the mainland and the island of Ceylon) cannot be doubted. This is richly documented by James Hornell; many early travelers and historians of travel have described the trade in detail.

Theophrastus reported that Indian pearls came from the pearl oyster, an animal like Pinna but smaller; Arrian alluded to the Indian

pearl fishery; see descriptions by travelers Cordiner, Dalrymple, Polo, Tavernier; economic accounts may be found in Balfour and Watt; Warmington's history of Roman-Indian commerce is useful.

The pinch is that these pearls seem uniformly to be taken from the vast beds of true pearl oysters that stretch out, under shallow seas, for many miles (often competing for space with *Pinna* mussels, it is true). Furthermore, there is considerable ambiguity in regard to pearls formed by species of the genus *Pinna*. Some authors account them to produce pearls that have an anomalous arrangement of crystals that results in their shattering when they dry out (see Boutan, Haas). Others note that these anomalous pearls are probably produced in caudal parts of the animal where there is lacking the layer of shell that produces conventional pearls – Turner and Rosewater believe that *Pinna* produces regular pearls (of whatever quality, otherwise) in the anterior portion of the body.

I am inclined to dismiss out of hand any notion that a particularly fine cloth (that is, of a diaphanous nature) was produced in India from *Pinna*'s Sea-silk. (Extended notice of diaphanous Indian textiles will appear in a later chapter.) With all those celebrated cottons, given such English names as 'Flowing Water' and 'Woven Air,' at hand and that expertise in dealing with them, why bother with diving for animals, killing them and engaging in the messy business of collecting, cleaning, spinning and weaving *Pinna*'s Sea-silk?

Travelers' stories of India's fabulously fine fabrics, beginning with the earliest Europeans to visit India, are legion. No traveler, early or late, hints at the use of Sea-silk in Indian manufactures. Similarly, not even the most minute and encyclopaedic accounts of Indian fibers and manufactures suggest its use. That *Pinna* ever figured in the Indian economy may be further doubted upon the authority of the *Kautalya* (see also in regard to it, Thapar): an exhaustive list of dutiable goods and services, whose aim was a rational taxation system where one doubts that any possible product or service was overlooked.

That there are several species of *Pinna* in Indian waters is well documented. A complete list may be found in Winckworth and a general account of species appears in Hornell's account of Indian shells.

After enquiry into every angle that I can think of, I find here nothing of substance.

References

Arrianus, Flavius, *Arrian*, by E.L. Robson, pp. 329, 331.

Balfour, Edward Green, *The Cyclopaedia of India* – useful products of mineral, vegetable and animal origin; in vol. I, under 'Byssus,' p. 536, he mentions Sea-silk only in regard to the Mediterranean; comments on Indian animals refer only to the pearl oyster.

Blümner, Hugo, *Technologie und Terminologie der Gewerbe und Kunst bei Griechen und Römern*, I, section 10.

Boutan, Louis, *La Perle*.

Casson, Lionel, *The Periplus Maris Erythraei*; section 59 is on pp. 87, 89; his account of Kolchoi is on p. 226; p. 266, he accounts the central parts of the section as "too defective to permit plausible emendation."

Cordiner, James, *A Description of Ceylon*; he described the pearl fishery, vol. II, pp. 36-46; this work was mistakenly cited by William Vincent in 1814 as having an account of the gathering of the byssus fibers of *Pinna*; it has nothing of the sort, the pearl oyster only being considered; its byssus is short and coarse: and, of course, is not gathered for any purpose.

Dalrymple, Alexander, *An Historical Collection of the Several Voyages and Discoveries in the South Pacific Ocean*; vol. I ranges into the East Indies; although claimed by Vincent to concern the gathering of byssus fibers, the account concerns only the pearl fisheries of the Sulu Sea (see comments on Cordiner); it is, in other respects, a wide-ranging and useful book with a very misleading title.

Daremberg, Ch., and Edm. Saglio, *Dictionnaire des Antiquités*; see 4(1), pp. 484-485, for account of *Pinna* and related matters.

Gordon, Alexander, "Yates, James (1789-1871)," *DNB*, 21: 2110-2111.

Haas, Fritz, "Natural history of the pearls."

Hornell, James, *Report to the Government of Madras on the Indian Pearl Fisheries in the Gulf of Mannar*; his version of the 'Periplus' account, with its reference to "fine muslins sprinkled with pearls," is on p. I; with his statistical analysis of the resource, he included a grand succession of historical

references to the pearl fisheries.

Hornell, James, *Indian Mollusks*; his account of the "several species of Pinna" that occur in Indian waters is on pp. 60-61; *Pinna bicolor* is common on the east coast and in sandy areas often forms a main place of attachment of pearl oysters; he reports that threads have occasionally been spun from Pinna's byssus fibers but declares the procedure a mere curiosity and it is most unlikely that he means to infer that this had ever been done in India.

Huntingford, G.W.B., *The Periplus of the Erythraean Sea*; I have quoted from his work in the main text of this chapter; on p. 140, he dismisses any notion that the Greek word that transliterates as 'pinikon' has anything to do with Pinna; it is used here, he says, for pearls.

Kautalya, *Kautilya's Arthasastra*, Shamasastri's translation, 4th ed.; a great collection of terms for objects, processes and activities, an effort being made to list every function that might be taxed; see Thapar.

Laufer, Berthold, "The Story of the Pinna and the Syrian Lamb"; the classic story of Pinna in English; his general support for the Yates theory is tempered in various ways: p. 108: "nothing about such a textile is known to us from India, ancient or modern; and, in view of the deep-rooted Hindu aversion to the taking of animal life, I even have the feeling that a textile secured from an animal, whose death for this purpose was necessarily involved, could not well have been an Indian idea, at least in its origin not a Hindu invention." While the second statement must be tempered by realization that pearls are always gathered at the expense of the life of the animal that produces them, it is to be emphasized that Laufer recognized what a slender reed the 'Periplus' was and suggested, at most, that it might be inferred that the idea of producing cloth from Sea-silk originated somewhere in the Orient.

Macdowell, David W., "The early Western Satraps and the date of the Periplus."

McCrinkle, John Watson, *The Commerce and Navigation of the Erythraean Sea*, p. 14, item 10.

Marquardt, Karl Joachim, *Das Privatleben der Römer*, p. 500.

Mommsen, Theodor, and Hugo Blümner, *Edictum Diocletiani de Pretiis Rerum Venalium ... Der Maximaltarif des Diocletian*, p. 159.

Müller, Karl, *Geographi Graeci Minores*, vol. II, 'Periplus Maris Erythraei,' pp. 257-305; see pp. 300-301 for his thoroughly annotated version of the

Yates section.

Needham, Joseph, *Science and Civilisation in China*, vol. I, p. 201; his version is not vastly different from Yates's conclusions; he takes the Greek word 'Pinnikon,' of which there are five references in the 'Periplus,' to refer to Pinna and its Sea-silk.

Passow, Franz, *Handwörterbuch der griechischen Sprache*; Pinna, 2: 922.

Pauly, August Friedrich von, and Georg Wissowa, *Paulys Realencyclopädie der Classischen Altertumswissenschaft*; in 14(2): col. 1684.30, Hans Rommel denies that the 'Periplus' reference is to Pinna and its byssus; rather, it is to pearls and the pearl oyster.

Polo, Marco. *The Travels of Marco Polo the Venetian*, transl. by Marsden, rev. with a selection of his notes ed. by Thomas Wright, 1912; the account of the pearl fishery, pp. 380-384, is an early report.

Polwhele, Richard, *Biographical Sketches in Cornwall*; see account of John Stackhouse, pp. 12-17; in it there is reference to Stackhouse's strictures on William Vincent's account of the 'Periplus.'

Schmitter, M.-Th., "Subsericae Vestes"; a learned effort to comprehend various non-silk fabrics, apparently including Sea-silk; his reference to the 'Periplus' is on p. 215.

Stackhouse, John, "Remarks 'On an Error in the Periplus' "; points out that a reference to a spinnable fiber from a bivalve mollusk would be to Pinna, not to the pearl-oyster; he was correct, whoever was right in regard to the question of Pinna in the 'Periplus.'

Tavernier, Jean-Baptiste, *Travels in India*, transl. from the French ed. of 1676; 2nd ed. I: 46-47; II: 6-7; the pearl fishery, II: 84-98.

Thapar, Romila, "State weaving-shops of the Mauryan Period"; a good account of the high development of weaving industries at the time of the *Arthasastra* (see the Kautalya).

Theophrastus, *De Lapidibus*, pp. 71, 113.

Turner, Ruth D., and Joseph Rosewater, "The Family Pinnidae in the western Atlantic"; I cannot see that their reference to pearl fishing reported by Alexander involved Pinna.

Vincent, William, *The Periplus of the Erythraean Sea*; his discussion of section 59 is in vol III of whole work, part II of the 'Periplus,' pp. 471- 472.

Vincent, William, "Error in the translation of the Periplus of the Erythrean Sea"; see comment by Stackhouse.

Warmington, E.H., *The Commerce Between the Roman Empire and India*; a thorough account of the trade in pearls, pp. 167-171; pp. 172-173, he casts serious doubt on Yates's theory that Pinna's Sea-silk was gathered and processed on the Indian coast; he feels that all references are to pearls and the pearl-oyster.

Watt, George, *A Dictionary of the Economic Products of India*; a multi-volume account with a substantial bibliography, I:xiii-xxii; the absence of any reference to Pinna or Sea-silk may be accounted definitive.

Winckworth, R., "Marine Mollusca from South India and Ceylon." III: Pinna, with an "Index to the Recent Species of Pinna"; a notably good general account of the genus; the list of all names ever proposed, pp. 290-297, is useful.

Yates, James, *Textrinum Antiquorum*; his valuable account of "The fibres of the Pinna" is pp. 152-159.

Sea-Silk: Christian Scribes, Pagan Philosophers, Diocletian's Price-Fixing And The Age Of Bestiaries

Having journeyed through five chapters without a trace of Sea-silk, the time has come to put it, however insecurely, in the firmament of time. A long, elusive tangle it is. Nor do we see Pinna and her golden beard more clearly at the end of this thousand years than at its beginning. Indeed, without the incisive statements that came in the first century of this history, in the West we might very well have let the entire matter fall through the collander of historical chance.

The Pagan Past, Continued

We have already seen the beginnings of the Christian Era in its first century in the grand gathering of information and misinformation by Pliny. It is realistic to understand that much of the learned world continued to believe what Pliny had believed. Masterful distillations of the times can be found in Daremberg and Saglio, Keller, Pauly and Wissowa and Warmington.

Plutarchus (ca. 46-120 AD), a Greek, wrote on "the cleverness of animals" in *Moralia*, including some sly comments on Pinna and

the Pinna-guard and their commentators. In regard to animals that exemplify a special partnership, "that is, symbiosis," he listed the Pinna-guard, "over which Chrysippus spilled a very great deal of ink." "Now the pinna-guard is a crab-like creature, so they say, who lives with the pinna and sits in front of the shell guarding the entrance. It allows the pinna to remain wide open and agape until one of the little fish that are their prey gets within; then the guard nips the flesh of the pinna and slips inside; the shell is closed and together they feast on the imprisoned prey."

Nemesius (fl. ca. 130), ever mindful of the intricacies of the Creator and His work, merely mentioned Pinna as among various animals of the sea.

Oppianus (fl. 188-200 AD), probably a Greek native of Cilicia, left an extensive early account of hunting and fishing in "Cynegetica" and "Haleutica." He dutifully recounted the intimacies of Pinna and Pinna-guard. He wrote of the Argonaut (paper nautilus), two species of octopus, cuttlefish and squid but left no record of enmity between Pinna and the octopus group. That his purpose was to moralize as much as to instruct is evident: "A shell again keeps the plains of the deep, wherein dwells a fish called Pinna. The Pinna herself is weak and can of herself devise nothing nor do aught, but in one house and one shelter with her dwells a Crab which feeds and guards her; wherefore it is called the Pinna-guard. Now when a fish comes within the shell, the Crab seizes the unheeding Pinna and wounds her with crafty bite. Then in her pain she claps her shells together and so contrives to catch within a prey for herself and her companion, and they take a common meal together. Thus even among the swimming tribes that travel in the water some are crafty and some are stupid, as among us men, and not all have a right understanding."

Oppian nowhere in these two works writes of Sea-silk or its gathering and use.

There is little that is new in Aelian (c. 170-235 AD) that is not pure embroidery of an old tale. In *On the Characteristics of Animals*, Pinna is a bivalve marine creature that opens its shells "and extends

a small piece of its flesh like a bait to fish that swim by. The Crab however remains by its side, sharing its food and its feeding-ground. So when some fish comes swimming up, the Crab gives the Pinna a gentle prick, whereat the Pinna opens its shell wider and admits the head of the approaching fish ... and eats it."

In an intriguing hodge-podge drawn from many sources, some of them now otherwise lost, Athenaeus, a Greek native of Naucratis, Egypt (fl. end of 2nd century/beginning of 3rd century), left several references to Pinna and related matters. He mentions the high art of weaving in early Greece but does not implicate Pinna. He hints that Pinna figured among items deemed to be aphrodisiacal: 'Pinnas, crayfish, bulbs, snails, buccina, eggs, extremities, and all that.' Pinna was included, perhaps, because of its bulblike attachment to the substrate.

Athenaeus has several references, none entirely clear, in regard to Pinna as food: "... the conchs, scallops, mussels, pinnas, and razor-fish ... oysters and limpets." Razor-clams held a high rank as dainties. Some parallels are found between Pinnas and oysters; among desirable tidbits: "A tiny polyp and a squid, a crayfish, lobster, oyster, cockles, limpets, razor-fish, mussels, pinnas, scallops from Mitylene; bring small fry – red mullet, sargue, grey mullet, sea-perch, crow-fish." There is a long and detailed account of shellfish as food, with alleged medicinal and digestive qualities, with a careful regard to the etymology of words. Few species seem to have been overlooked as dainties of one sort or another. The citation by Athenaeus of Aristotle in regard to Pinna adds nothing to what we have had: "Pinnas grow in an upright position from the sea bottom ..."; they contain the 'pinna's guard,' "which may be a small prawn or a small crab." He makes Epaenetus say, in the *Art of Cookery*, that the inside of the Pinna is called the "liver." His quotation from Chrysippus relates the standard story of Pinna and her crab-guard.

Athenaeus quotes at length from Diphilus, rating shellfish as to edibility and related qualities. Limpets "are tough, with little juice, not very pungent, of good flavour and easily digested; when boiled, too, they are tolerably well-flavoured. Pinnas are diuretic and filling, but hard to digest and assimilate. ... The purple-shells stand

midway between the pinna and the periwinkle; for their necks have much liquor and a good flavour, while the remaining part of them is salty and sweet, readily assimilated, and good for modifying the humours." Nicander of Colophon speaks of the bottom of the sea as "the hiding-place of the pinna itself." Various authors are quoted as listing pinnas among shellfish, with an obvious emphasis upon those that were edible.

Athenaeus has a considerable account of pearls as a product of mollusks found in India, where it occurs in "a shell-fish similar to the pinna, but smaller." He nowhere credits Pinna to India, even as a producer of pearls. However, in regard to mollusks elsewhere: "Now the purest pearls, those which are most lustrous and large, are produced in the pinna which remains on the ocean bottom, whereas the pinna which grows at the surface, emerging above the water and receiving the direct rays of the sun, is of inferior colour and of less value." There is some question whether 'pinna' is not here used for more than one kind of bivalve; maybe the true Pinna was not involved at all.

It would be a mistake to take as having anything to do with Sea-silk the diaphanous dresses that Athenaeus reported worn by courtesans at a wedding celebration. In endless lists of rich viands – it is indeed "The Sophist at Dinner"! – Pinnas are variously mentioned.

For all the evidence that Greeks of all stations had long known about Pinna – as food, if nothing else – there appears to be no reference to it in what is referred to as "The Greek Anthology," a selection of choice epigrams from about 700 BC to AD 1000 or later. Neither Paton's full translation nor Norman Douglas's 'Birds and Beasts' indicates any interest in Pinna whatsoever. In fact, Douglas makes the only mollusk eaten the ous, the ormer or ear-shell – not even oysters, although they were sought for their pearls.

Keller claimed that Martial (c. 40 - c. 104) probably meant Pinna when he mentioned an insipidly flavored shellfish called "Pelorida" or "Peloris." His argument was that Pinna is huge and insipid in taste, in contrast to the mollusks that are nowadays (that is, properly) called pelorids. "You gorge Lucrine oysters, watery mussels from

Pelorus feed me.”

Marquardt summarized the matter of Pinna in Roman life, listing Sea-silk among “Unusual materials.” While he may have assumed its use to go into great antiquity, he cited no evidence for that view.

A few references seem to indicate knowledge of Sea-silk in Rome before its later identification mainly with Christian scribes. Alciphron (fl. perhaps 2nd century) wrote, in one of his “Letters of Fishermen”: the master of the vessel “... sent us orders for sponges and for sea-wool, which grows expressly for a spoiled darling’s robe.” The translator takes this to be “the *byssus* which attaches the bivalve *pinna* to the rock or to the sand.” One is not to be misled by this modern use of the word *byssus*. In the days of Alciphron and Philostratus (b. 172), that word meant a vegetable fiber. As a general indication of much lack of recognition of Pinna by Alciphron, Keller thought his reference to a pelorid mollusk that he characterized as very large was likely to Pinna.

The discovery of fragments of a fabric made of what has been authoritatively identified as Sea-silk in 4th century Hungary (then a part of the Roman Empire) is of singular importance. This item and other materials from the site on the Tátorberg, near Aquincum-Budapest, have been reviewed by Lajos Nagy and further evaluated by J.P. Wild.

Some reference to the elegant work of Pfister in Roman Syria will be noticed later. Suffice it to say here that, among a very great many archeological fabrics, he found no evidence of Sea-silk.

In his account of the “buildings” of the Byzantine emperor Justinian (483-565), Procopius of Caesarea (fl. 6th century), private secretary of Justinian’s general Belisarius, related how Justinian established a ruling group of five satraps in that part of Armenia on the Euphrates River west and north of the city of Amida. They received the symbols of their office only from the Roman Emperor. “It is worth while to describe these insignia, for they will never again be seen by man. There is a cloak made of wool, not such as is produced by sheep, but gathered from the sea. *Pinnos* the creature is called on which this

wool grows. And the part where the purple should have been, that is, where the insertion of purple cloth is usually made, is overlaid with gold. The cloak was fastened by a golden brooch in the middle of which was a precious stone from which hung three sapphires by loose golden chains. There was a tunic of silk adorned in every part with decorations of gold which they are wont to call *plumia*. The boots were of red colour and reached to the knee, of the sort which only the Roman Emperor and the Persian King are permitted to wear.” The editor remarks that ‘*Pinnos*’ is usually written *Pinna*; *plumia* means embroidered; he says that the description is obscure but “the general idea seems to be that where in the dress of high officials purple was normally used, this space was done in gold.” I might add that this reference to gold overlay, etc., should not in any way be equated with a ‘cloth of gold’ made of Sea-silk – it was no doubt decoration made of metallic gold. Note that the accompanying tunic was made of silk – not Sea-silk.

It is pertinent to note that Theodor Reil found no evidence of the use of Sea-silk in Hellenistic Egypt. He gave a thorough account of linen, wool, cotton and silk.

Xenocrates, the physician, of Aphrodisias, Cilicia (perhaps ca. middle 1st century), in a work on ‘Fishes as Food’ that has not been fully translated, commented on both the lore of natural history of Pinna and the Pinna-guard and the use of Pinna as food. According to A. Steier, in Pauly and Wissowa, his account regarded Pinna as ‘tasty and nourishing and eaten stewed and roasted. They were hunted in spring and summer, because they were then at peak quality. The Greeks, however, thought them hard and indigestible.’

Christian Scribes and Pinna’s Sea-Silk

From what we have just read, it is clear that news of Sea-silk’s fame had not spread very fast nor very far. But that the exploitation of Pinna for its Sea-silk was occurring early in the Christian era is clear. Just who perfected that discovery, where it first occurred, nobody knows. There is a question of what Sea-silk would have been called. Lexicographer E.A. Sophocles, surveying Greek words for a period including this era, listed various versions of the word Pinna, one of

them being a related term *Pinnikios*, usually translated in accounts of the 'Periplus of the Erythraean Sea' as the pearl oyster; *Pinninos*, was held to mean 'of the Pinna' and meant mother-of-pearl. A later term, pertinent here, was held to mean 'with hair like the *pinnikon*,' surely an apt enough descriptive word. That anyone actually used such a term for Sea-silk, I doubt.

What we have is: Tertullian (Quintus Septimius Florens Tertullianus) (ca. 155 - after 220), an early Church father, in *De Pallio*, was quoted by Yates as noting rather elaborately: "Nor was it enough to comb and sow the materials for a tunic. It was necessary also to fish for one's dress. For fleeces are obtained from the sea, where shells of extraordinary size are furnished with tufts of mossy hair."

In a favorite way of moralizers, Christian teachers began to point to the glory of God as exemplified in nature and the weakness of man. Thus, St Basil the Great, Archbishop of Caesarea (ca. 330-379): "Whence had the pinna its gold coloured wool? that colour which is inimitable!" (Stolberg, 1797) or, as Yates put it: "... 'that golden fleece' of the Pinna, which no artificial dye could imitate." Note that, under the influence of modern zoological taxonomy and the need for common names bleached of classic connotations, Agnes Clare Way's translation of St Basil drops the Greek word *Pinna*, with its rich history, and you have merely: "How do the sea pens produce their golden byssus, which no dyer up to this time has imitated?" Similarly, the once universally understood term *Purple* (or some Latin equivalent) becomes a totally faceless mollusk (without even a scientific binomen): "How is it that the shellfish bestow on kings the purple robes which surpass even the flowers of the meadow in beauty of color?"

Because St Basil's emphasis was upon color only, it may be worth reemphasizing that the ancient Mediterranean world did not need a source of *fine fabric* (supposing for a moment that we believe *Pinna*'s Sea-silk was ever spun and woven into such diaphanous fabrics): they already had them. G. Schaefer's history of the loom reports evidence of weaving and looms in Egypt by about 3400 BC; some textiles of an exceedingly diaphanous nature were soon being woven from byssus. The reference is to vegetable byssus, doubtless linen here, not *Pinna*'s

Sea-silk. G.A. Faber traces the history of wool, the first raw material for weaving in Greece and Rome. To Faber, byssus was a fine linen, a fiber that was common in Egypt and often imported into Greece and Rome. Faber was not unaware of Sea-silk: it was a rare material, perhaps almost a novelty, like stuffs woven of fleecy hairs on leaves of acanthion, a species of thistle, the hair of rabbits, beavers and camels and, even, fibers of the mineral asbestos.

The historian Edward Gibbon reviewed the history of dyes and fabrics in the Roman Empire. An exception to the rule that only royalty could wear purple was made in the case of female dancers – possibly, the same permissiveness applied to luxuriant but diaphanous fabrics, that gave viewers the best of both worlds? Gibbon reviewed the history of silk, early on exploited by seller and buyer alike for the ease with which it could be imported (for a price!) from China, unravelled and multiplied into stuffs that one supposes Gibbon meant to refer to as fitted for "transparent draperies and naked matrons." In addition, Gibbon wrote, Sea-silk was known to the Romans (he does not say when nor where they first knew of its use), produced by "a shell-fish of the Mediterranean, surnamed the silk-worm of the sea; ... and a robe obtained from the same materials was the gift of the Roman emperor to the satraps of Armenia." "The fine wool or hair by which the mother-of-pearl affixes itself to the rock is now [meaning in his time] manufactured for curiosity rather than use."

Yates dated first notices of Sea-silk early in the Christian era.

It may be pertinent to point out the surprising absence of any mention of fabrics made of Sea-silk among the numerous Coptic fabrics of the Egyptian area studied by Marie-Hélène Rutschowskaya.

Diocletian's Price-Fixing: Added Evidence of the Use of Sea-Silk

Due to the fragmentary nature and other ambiguities of some entries in original records of the Empire-wide efforts of the Emperor Diocletian (284-305; the Edicts are dated 301) to stabilize prices, conclusions here must be somewhat tentative. It was a work-a-day list of the maximum charges that could be made for all identifiable jobs, services and materials. Names used are, of course, the jargon

of each trade and some of them have proved difficult to identify.

Theodor Mommsen and Hugo Blümner were the first to argue forcefully that the Edict included references to the prices that could be charged for dealing with what they took to be fibers of Pinna's Sea-silk. They noted the wages given to weavers of various fabrics; a fiber called, in Greek, *Thalassio* (etc.), was unknown to them but they were interested that it was on a par with costlier weavings. It could not be, they were sure, purple-dyed (Tyrian purple, from the univalve mollusk *Murex*) wool. It was unlikely to have meant merely sheep wool imported from overseas, for such wool was no different, nor differently treated. They had no patience with the notion of a 'sea-living sheep' (although, as we shall see, the idea was current), thereby missing a chance to show its identification with Pinna. They cited affirmatively references to Tertullian, Procopius and St Basil.

Caputo and Goodchild extend somewhat knowledge of the intricate details of documenting each piece of the Edict. Siegfried Lauffer has further documented the Edict, bringing in perhaps extraneous notions that the term 'lana marinus' (etc.) may be involved. See in this respect also Rolf Heine. Possible involvement of various marine plants in this tangled history will be considered later.

While quite aware of the existence of fabrics of Sea-silk and of claims that the Edict referred to them, R. Pfister argued stoutly against that interpretation. He pointed out that, in all the rich finds of fabrics at the Roman site at Palmyra, Syria, nothing made of Sea-silk had ever been found. His conclusions, however valid for the Palmyra site, are countered by Lauffer and by J.P. Wild.

Tenney Frank's excellent account of the Roman economy at the time of the Edict does not mention Sea-silk in any form (although he knew that it was mentioned in the Edict), perhaps emphasizing the rarity of its use.

Pinna in the Bestiaries

It is clear enough that much of Pinna's repute, including the more or less fantastic relationship with its Pinna-guard, was of the bestiary type: a sort of folk natural history, finally always overlain by a veneer

of moralizing and literary gloss. Moralizing was partly a sop to the Church but the bestiary even became a popular vehicle with many churchmen as a way of expounding religious principles.

Many of the references to Pinna that have been cited, including some reports by the great Aristotle, are at the bestiary level. However, my first undertaking here is to enquire into possible references to Pinna or the Pinna-guard in what may be called the *official* bestiaries: a work long circulated in manuscript form that came to be called the *Physiologus*. Despite variations, there is considerable similarity in the kinds of animals treated and the stories related in their regard. Latin versions of this central type go back to about the year 400. The result of the initial query, whether Pinna is mentioned, is negative, as can be gathered from Florence McCulloch's learned study of Latin and French bestiaries. See also Ben E. Perry's "Physiologus" in Pauly and Wissowa.

However, some works that seem parallels of the *Physiologus* do list a few references to Pinna or at least to mollusks, otherwise notable by their absence in the basic group. For example, in what is considered a Syriac *Physiologus* (which may date as early as the 5th century, as late as the 12th century), there is reference to *pûnôs*, of which the plural is the Greek *pinnas*, a material made from an animal so called. "These give a golden wool, called *b'rônêjon* – so called because of "its already being colored so skillfully that no dye is needed."

Hesychius (5th or 6th century), in his Greek *Lexicon*, gave a thorough etymology of the word *Pinna* (and variants). A.S. Pease, in an account of Cicero's *De Natura Deorum*, states that there was no Latin word for Pinna (originally, Greek *Pina*). Translations into Latin from the Greek either used the the word itself (which could be confused with the Latin word for *feather*) or some term that the Romans used to refer to that animal. Instead of 'Pinna,' we may get a pen-shell (roundabout, because it is somewhat shaped like an ancient pen made from a feather) or, more simply, just a mollusk. The name of a better-known mollusk may be used, even though Pinna is surely intended. Thus, George Boas's modern translation of Horapollon (Horus Apollo; 4th century), a Hellenic Egyptian, tells the story of Pinna and the Pinna-guard: but instead of 'Pinna' we are given to

understand that the mollusk is an oyster. (That the crab in question is a symbiont of several sorts of mollusks complicates matters; but, in fact, Horappolo originally used the term *Pinna*, as properly noted by Baudouin van de Walle and J. Vergote.) Horapollon implied that Egyptians drew a hieroglyphic figure that represented this: "When they wish to indicate a father or a man careless of his welfare, but who is provided for by his household, they draw an oyster and a crab. For the crab remains stuck to the shell of the oyster and is called an oyster-guard for this reason. Accordingly, the oyster opens wide in its shell when it is hungry. When it has opened up to let in a tiny fish, the oyster crab pinches the oyster with its claws, feeling which the oyster closes its shell and thus catches the little fish." The implication here is that the oyster (or *Pinna*) is the careless member of the association.

Unfortunately, no modern authority has substantiated Horappolo's claim in regard to the Egyptian hieroglyph. B. van de Walle and J. Vergote cite only Greek/Roman authorities in regard to his story. While Sir Alan Gardiner gives a hieroglyph for an unnamed bivalve shell, with no claimed relevance to *Pinna*, he appears to be in error. François Daumas et al. consider the figure to stand for a "ptérocère," a large snail-like univalve gastropod of warm seas (actually, the symbol probably represents the operculum of that mollusk). No one knows of any symbol that can be interpreted as *Pinna* and its *Pinna*-guard. See also the reference to Valeriano Bolziani, cited further along. For a commentary on Horappolo and the modern revival of interest in hieroglyphic studies, see the enlightening study by Erik Iversen.

It was an age, of course, little sophisticated in biological understanding, where, as Florence McCulloch has written, the term *Mermecolion*, which one would ordinarily think of as an ant-lion (that is, a larval insect that feeds on ants and other stumblers into its snaring pit of sand), was turned by befuddled scribes and illustrators into (of all things!) a pearl oyster.

Saint Isidorus, Bishop of Seville (ca. 560-636), in his *Etymologiarum sive Originam*, unfortunately not available in English, lists *byssus*, silk, half-silk, silk worms, fiber sources, all without any apparent

reference to *Pinna* and Sea-silk.

As added evidence that the ancient world did not know of a fabric of renown made of Sea-silk, it is worth consulting statements of the Greek Pausanias (fl. 176 AD), to be quoted in the chapter on byssus.

***Pinna* in the Later Bestiaries, to the End of the Middle Ages**

Although the history of Sea-silk as the product of the fabulous Water-sheep of Moorish Spain and North Africa is parallel to the present account, it has somewhat separate roots and will be considered later. The present segment of *Pinna*'s history follows, as far as evidence allows, its tumble through the chanceful avenues of history in the latter part of the Middle Ages. St Andreas (Andrew), Archbishop of Crete (ca. 660-740) described the riches of the sea by accounting *Pinna* as the source of a marine wool that supplemented the land-grown sort.

It is difficult to get a handle on references to *Pinna* in Constantinus VII, Porphyrogenitus, Emperor of the East (905-959), since relevant parts of his works have not appeared in English. Schmitter cites Constantine's *De Cerimoniis* as referring to the brilliance of coloration of Sea-silk and to its use in ancient times. In Reiske's annotations to that work, the 18th century industry in Sea-silk at Taranto was cited to substantiate Constantine's statement. His *De Thematibus*, a geography of the Byzantine Empire, refers to highly colored wool produced by a shellfish.

Unlike most lists of animals that parallel older bestiaries of the *Physiologus* type, "De Bestiis et aliis rebus liber tertius" (a work that has been attributed to Hugo de St. Victor [1096/7-1141] but now considered not by him) contains several shellfish and crabs. There is no mention of *Pinna* or Sea-silk.

The great German polymath St Albert the Great (Albertus Magnus) (ca. 1200-1280) had his feet firmly planted on the doorstep to the modern world but his knowledge of more ancient wisdom was unparalleled. Combining his great learning with the innocence of the bestiarists, he managed to have the best of both worlds – and carefully retained even more than one version of the old. Perhaps it

was nothing more than his unwillingness to omit things seen not by himself but reported by authorities he did not want to offend. First: "Aureum Vellus" (Golden fleece) is a marine animal like a sponge, indeed it belongs in the same category as sponges, but it is much finer and softer, in the fashion of fleecy wool. [The editor/translator identified this as "probably the byssus, or mass of adhesive threads secreted by the foot of the Lamellibranch, *Pinna nobilis*, which is a bivalve mollusk, not a sponge" – but did not see fit to list the entry under *Pinna* in the index.] Its downy filaments give off a shining brilliance like threads of gold, and these elongated strands spread out like fleece. When it is underwater in the sea, it moves by contraction and dilation as the sponge does, but the chances of finding it are limited because of its rarity. To illustrate its singularity, Dares Phrygius, in his *History of Troy*, asserts that the golden fleece found in Phrygia was a cause of the Trojan War between the Greeks and the Phrygians." (See *Hortus Sanitatis*, a few paragraphs hence.)

And then, under "Perna (Noble pen shell)," we have: "a marine animal belonging to the class of bivalve mollusks ... characterized by its large size and golden yellow color. Within the shells themselves the animal is noted for a very precious reddish-golden fleece used as a prized decoration for garments and robes." Without bothering to explain how *Pinna* had become *Perna* (the latter is the Latin word for 'ham'), the translator correctly identified this as *Pinna* but got relatively little else right. *Pinnas* certainly were more than "6 to 7 in. in length" within historical time. Nor is there much substance to his notice of a "cloth of gold called 'tarentine'" that "for centuries has been woven from the carded and spun filaments."

Manuel Philes (ca. 1275-1340) left, in his *De Animalium Proprietate*, some account of *Pinna*. According to Otto Keller, he wrote of Sea-silk being woven into fabrics, some of them being 'as fine as cobweb.' I treat this in my chapter on fine fabrics.

Michael Apostolias (fl. 1462; d. 1480?), as reported by Leutsch and Schneidewin, recorded Greek proverbs that include a reference to *Pinna* but I have seen it only in Greek.

Giovanni Pierio Valeriano Bolzani (1477-1558/60) brought out a Latin edition of Horapollo. It has not been translated into English. There is considerable matter in it on both *Pinna* and various crabs. While the work is noted for its influential illustrations, having appeared in a great many printed editions, there is unfortunately no picture of *Pinna*.

Finally, the story ends with the quaint allusions to *Pinna* in Noel Hudson's *An Early English Version of Hortus Sanitatis*. This work first appeared in the late 1400s or early 1500s. It features many wonderful illustrations, each accompanied by a few lines of old black-letter early English text, not at all easy to decipher. The index is helter-skelter. Although *Pinna* is treated, it comes under "shellfish" merely in the editor's index. You have to read the entire book, and trust to luck, in your search for an item that you think ought to be present. Since Hudson provided no transliteration into modern typeface, reading it is no easy matter.

Anyway, surprise number one: St Albert's Aureum vellus – with an illustration! (The original typesetter used a vowel with a bar over it when that vowel was followed by an 'n' sound; here, I have simply introduced the 'n' as an italicized letter.) "Aureum vellus saith albertus is a fische of the see lyke a sponge; but it is moche softer & bereth a substaunce lyke wolle whyche hath a golden colour & it may be sponne & brayd or wouen they be but selden founde yet they were founde in the tyme of the warre betwene the troyans and the grekes." The illustration is of nothing in land or sea: three oval critters without legs or other appendages, with fur streaming along their sides to the back end; the anterior end is provided with a kind of neckless turtle's head which has a mouth and eyes.

Surprise number two: "Perua [the letter is definitely 'u' here, although obviously 'n' – *Perna* – was meant] is a muscle very great & pelowe and win [within] the shell it hathe a fayre shynynge skinne that is very costly whereob [whereof?] in those partyes women be rychely attyred." This matter is simply sandwiched in at the end of Cap. lxxviii, mainly on the "Platanista," shown as a kind of mermaid. The illustration here is an added bonus: it is placed below the mermaid and oriented horizontally and is possibly the side view of

a clam-shaped animal; there is a stylized but realistic fish-like (but unmussel-like!) head sticking out to the left.

Surprise number three: Cap. lxx, "Pinna [no illustration] is a fische y^t layeth always in the mudde and hathe always a lodisman [?] & some name it a lytel hoge & it hathe a rounde body & it is in a shell lyke a muscle it layth in the mone [?] as it were dede gapyng open and than the smale fische come into his shel wenyng of him to take their repaste but whan he feleth th[at][?] is almoste ful than he closeth his mouthe & taketh them & eteth them & parteth them amonge his felowes." (The account then goes directly into the story of the Plaice.)

It is notable that Pinna does not show up in the late bestiaries. Richard Barber's *Bestiary*, based upon late 12th century sources, has the various beasts arranged in a vague way by major types; there are a few invertebrates, all accompanied by a phony etymology and much moralizing and preaching. In spite of the morals that could have been drawn from its example, Pinna is not mentioned.

References

Aelian, *On the Characteristics of Animals*, p. 191; I have three references to him from Philes but two seem not to apply.

Ahrens, Karl, *Das "Buch der Naturgegenstände"*, p. 75; see Berthold Laufer, p. 113, note 1.

Albert The Great, *Man and the Beasts*, pp. 332, 367.

Alciphron, et al., *The Letters of Alciphron, Aelian and Philostratus*; according to Keller (1913[2]: 550), his use of 'peloriden,' in reference to a large mussel (II, 2, 2), indicates that Pinna is meant; his reference to Pinna's "sea wool," p. 43, is convincing; the editor supposes this to have been intended for making all the diaphanous Tarentine fabrics but this may be doubted; see also p. 271.

Andreas, Saint, Abp. of Crete, *Orationes*, col. 1030.

Athenaeus, *The Deipnosophists*; there is a hint of Pinna as an aphrodisiacal food, 1: 277, as items of food, 373, 379; at 1: 385, he supposes Pinna to grow upright from the sea bottom, not from its byssus; the digestibility of Pinna is discussed 1: 395; the reference to pearls of Pinna are 1: 405; for

the girls dressed in see-through gowns, see 2: 95; further reference to food, 2: 119.

Barber, Richard, *Bestiary: Being an English Version of the Bodleian ... M.S. Bodley 764*.

Basil, Saint, the Great, *Exegetic Homilies*, usually referred to as the "Haexameron," Homily VII; in the English version by Sister Agnes Clare Way, p. 115, Pinna becomes merely the modern 'Sea-Pen.'

Caputo, Giacomo, and Richard Goodchild, "Diocletian's price-edict at Ptolemais (Cyrenaica)," a fragment that expands previous knowledge, according to Heine (1956: 50).

Cicero, *De Natura Deorum*, Libri Secundus et Tertius; see p. 863.

Constantinus VII, *De Cerimoniis*, with commentary by Johann Jakob Reiske, 1: 440; 2: 466-467; Reiske's reference to Keyssler's travels in Italy do not, of course, prove historical continuity with the period referred to by Constantine.

Constantinus VII, *De Thematibus*, p. 76, XII, 42 in Greek; vol. 58: col. 617, in Latin.

Daumas, François et al., *Valeurs Phonétiques des Signes Hiéroglyphiques*, 2, section K (Poissons. Coquillages), p. 388 (three various crescents, toothed in the lowest part of the inner curve, and variously oriented with the tooth either nearly upright or pointing to the left; reference here is to phonetic values of the symbols; there is nothing regarding identification except the bare assertion that the symbols are a "ptérocère"; I am sure the figure must ultimately be traced to the operculum of that univalve mollusk, not to the shell itself; these authors show nothing that can be considered derived from Pinna or a crab).

Diocletian, see: Caputo and Goodchild, Frank, Lauffer and Mommsen and Blümner.

Douglas, Norman, *Birds and Beasts of the Greek Anthology*; I have also checked the longer version ed. by W.R. Paton (5 vols., 1916-1918).

Faber, G.A., "Dress and dress materials in Greece and Rome," a discussion of various fibers used, including byssus (fine linen), p. 296; silk and Pinna's Sea-silk, p. 297; the latter can have been no more than a novelty fiber.

Frank, Tenney, *Rome and Italy of the Empire*, various references to fine fabrics, etc., excellence of weaving (not in Sea-silk!), pp. 164, 165, 202; pp. 305-421 is Elsa Rose Graser's version of Diocletian's 'Edict of Maximum Prices,' where apparent references to Pinna's Sea-silk are to be found on pp. 371, 379, 385.

Gardiner, Alan Henderson, *Egyptian Grammar*, p. 478; the figure said to represent a bivalve shell is a leftward reclining, dentated crescent; see various comments on Horapollo.

Gibbon, Edward, *The History of the Decline and Fall of the Roman Empire*, 6: 66-67, his whimsical account of silk and fine fabrics, and p. 68, the usual vague reference to Sea-silk's early history; his account of the silk trade, pp. 68-73, is useful.

Heine, Rolf, "Lana marina," perhaps inappropriately cited here; this a thesis that suggests use of Sea-silk in some way in the treatment of wounds and in ear infections. In addition to consideration of Diocletian's Price Edict (p. 50), there is also a discussion of what appear to be uses of various marine fibers or waddings, including plant material; this will be further considered in a chapter on marine fibers of plant origin – in light of this work, perhaps not as impertinent as would be at first thought; it does seem rather a waste to use Sea-silk to keep medicines from flowing out of the treated ear!

Hesychius, of Alexandria, *Lexicon*, p. 335.

Horapollon, *The Hieroglyphics of Horapollo*, pp. 108-109; it is notable that in the original Greek, the words *pinna* and *pinnophylax* are used (see Cicero, cited above, p. 863); unfortunately, no illustration of a hieroglyphic character of the sort alluded to is shown; see also "Traduction des Hieroglyphica d'Horapollon," by B. van de Walle and J. Vergote, pp. 236-237; insights into the place of Horapollo in hieroglyphic studies may be gained by reading B. van de Walle, 1961, and Erik Iversen, 1958; I am grateful to R.B. Parkinson for pointing out the work by B. van de Walle and J. Vergote; I have had further help from Alessandra Caropresi, Janice Klein and John A. Larson; Dr. Larson and his colleagues suppose that "Horapollo's charming metaphor must have come from his own fertile imagination"; see also discussion in text and under Daumas et al., above.

Hortus Sanitatis, *An Early English Version*, "Aureun," p. 128 (usually spelled aureum); "Perna," p. 149; "Pinna," p. 150.

Hugo De St. Victor (alleged author), *De Bestiis et aliis rebus libri*, vol. 3 (t. 177), col. 110.

Isidorus, Saint, *Etymologiarum sive originum*, some reference to *byssus*, XIX, xxii, 15; XIX, xxvii, 4; matter on silk, silk worms, XIX, xxii, 13-ff; fiber sources, XIX, xxvii, 1-ff.

Iversen, Erik, "Hieroglyphic studies of the Renaissance"; the nearly hermetic isolation of Egypt from the Christian world is clearly shown.

Keller, Otto, *Die antike Tierwelt*, vol. 2, 488, an account of various crabs, including the Pinna-guard; in Egypt a similar word meant a human parasite; Aristophanes and Pliny used the term for a tiny man; current use at Taranto more a curiosity than a regular commodity; use as food not very popular, since the flesh is mediocre.

Lauffer, Siegfried, *Diokletians Preisedik*t; the Greek version is fragmentary and telegraphic; in notes, 14, p. 264, seems most pertinent.

Leutsch, E.L., and F.G. Schneidewin, *Corpus Paroemiographiorum Graecorum*; II, *Apostolias et Arsenius*, P. 472.

McCulloch, Florence, *Medieval Latin and French Bestiaries*.

McCulloch, Florence, "Mermecolion – A Mediaeval Latin Word for 'Pearl Oyster.'"

Marquardt, Karl Joachim, *Das Privatleben der Römer*, 1: 500, a list of 'Unusual materials,' Pinna's Sea-silk; he takes the report of it as having been used in India, as claimed by Yates in regard to the *Periplus*, as dubious.

Martial, *Epigrams*; Keller (1913: 550) thought references (VI, 11, 5; X, 37, 9) to a large, insipidly flavored mussel to be Pinna.

Mommsen, Theodor, and Hugo Blümner, *Edictum Diocletiani de Pretis Rerum Venalium*, pp. 159, 167-168.

Nagy, Lajos, *Aquincumi Múmia-Temetkezés / Mumienbegräbnisse aus Aquincum*, the main account is in Hungarian, pp. 18-20; in the German summary, the account of the piece of Sea-silk is on pp. 37-38; the fabric is shown in a photograph, pl. IV, fig. 7.

Nemesius, of Emesa, *Cyril of Jerusalem and Nemesius of Emesa*, p. 233; this was originally in: Nemesius's *De Natura Hominis Graece et Latine*, Greek, p. 41, 42; Latin, p. 3.

Oppianus, *Oppian/ Colluthus/Tryphiodorus*, ed. by A.W. Mair; Pinna and its crab are treated in 'Halieutica,' II: 299, 301.

Paton, W.R., see N. Douglas.

Pauly, August Friedrich von, and Georg Wissowa, *Realencyclopädie der Classischen Altertumswissenschaft*, the part on Pinna by A. Steier is 16(1): cols. 787-789.

Pausanias, *Description of Greece*; see chapter on byssus.

Perry, Ben E., "Physiologus," in Pauly and Wissowa, 20(1): cols. 1074-1129.

Pfister, R., *Textiles de Palmyre*, p. 34, long discussion of his scepticism of prevalence of Sea-silk in Roman Syria; the richness of fabrics there and his knowledge of fibers, including Pinna's Sea-silk, cannot be doubted.

Philes, Manuel, *De Animalium Proprietate*, in the 1730 Latin version, "Pinna" is in Section 95, pp. 323-ff; a brief, not literal, version of part of it is in Keller, p. 549; see also Pauly and Wissowa, 1933: 788; there appears to be no English version.

Philostratus, Flavius, *The Life of Apollonius of Tyana*, a reference to fine cloth made of *byssus*, 1: 167, 169.

Plutarchus, *Moralia*, "The Cleverness of Animals," 12: 445, 447.

Procopius, of Caesarea, *Buildings (De Aedificiis)*, 7: 183, 185.

Reil, Theodor, *Beiträge zur Kenntnis des Gewerbes im hellenistischen Ägypten*, discussions of *bussos* pp. 5, 98, 116; there is a complete list of textiles mentioned in the papyri, pp. 116-122.

Rutschowskaya, Marie-Hélène, *Coptic Fabrics*, excellent history, beautifully illustrated; there is a great deal on dyeing, fibers used, methods of weaving; *byssus* is a fine linen, only.

Schaefer, Gustav, "Principles of the loom," diaphanous fabrics in ancient Egypt, p. 546, 552.

Schmitter, M.-Th., "Subsericae vestes," a name given to 'half-silken clothing': a thoroughly researched and very finely wrought account that is difficult to translate; his references to possibilities that 'half-silk' may be Pinna's Sea-silk, are pp. 214-216; there is a careful discussion of Diocletian's Price Edict and some indication that Schmitter accepts Yates's notions about the

origin of weaving of Sea-silk in India.

Sophocles, E.A., *Greek Lexikon of the Roman and Byzantine Periods*, 2: 891.

Tertulianus (Tertullian), Quintus Septimius Florens, *De Pallio*, col. 1039 (1844 edition); this is cited by many, translated by Yates, pp. 155-156.

Valeriano Bolzani, Giovanni Pierio, *Hieroglyphica*, "De Pinna," p. 285c, "De Cancro" (of crabs), pp. 284-285.

Walle, Baudouin van de, "Autour des Hieroglyphica d'Horapollon."

Warmington, E.H., *The Commerce between the Roman Empire and India*, 2nd ed.; pp. 167-171, pearls; mother-of-pearl, pp. 171-172; pp. 172-173, he doubts that the reference in the *Periplus* is to Pinna's Sea-silk; there is a good account of silk, including silks from worms native to Europe, pp. 174-175.

Wild, John Peter, *Textile Manufacture in the Northern Roman Provinces*. an excellent modern study; wool, pp. 1-10 (the Tarentine sheep produced "the finest wool in the ancient world"); silk, pp. 10-13, was highly regarded but was entirely an imported material in the Mediterranean world until the 6th century AD; linen, pp. 13-ff, the "most important of the bast fibers"; cotton, pp. 18-19, very rare early on and not one of the fibers of any general importance; Pinna's Sea-silk, p. 20, is included mainly on the basis of previous general knowledge and, especially, the discovery in Roman Hungary reported by Nagy.

Xenocrates, the Physician, of Aphrodisias, Cilicia, *De Alimentis ex Fluvialibus*, p. 129, in Greek; see A. Steier, in Pauly and Wissowa, col. 787.

Yates, James, *Textrinum Antiquorum: An Account of the Art of Weaving Among the Ancients*, his notable account of "Fibres of the Pinna" is to be found pp. 152-159; he is the major source of the belief that the use of Pinna's fibers was perfected in India.

Oriental Translations: Pinna Wool, Aquatic Sheep and Mermaid Fleece

However fantastic the notion – or who was pulling who's leg – reports that the Greek/Roman world harvested the fleece of an aquatic (some say 'marine') sheep were widespread, reaching into the Orient by way of the China trade. Some versions were current in the Arab world

from Syria to Spain. The Arab material will be treated later.

In the beginning, perhaps the story was a way to protect a source. Maybe, on the other hand, it was an innocent joke, to go alongside a popular philosophy that the aquatic world has a species of animal that, in some ways, is an equivalent for each land species. A certain unreality in it may have been tacitly understood by all parties, just as one knows that a 'sea-horse' has few attributes of the land animal.

The two versions of the aquatic sheep (Chinese and Arab) have another thing in common: both died without practical issue. Without the modern discovery and translation of early Chinese and Arabic writings, a study of modern cultures in those areas would not tell you that so strange a belief ever existed.

Several themes are involved, overlapping, disparate, dubiously related: an aquatic (or marine) sheep, a land-bound but vegetable sheep that was also sometimes actually 'planted,' the latter perhaps not the same in all cases with the Scythian lamb (*Agnus Scythicus*). The extent to which these are clearly related to Pinna's Sea-silk has been the focus of a great deal of controversy. I can do little more than cite relevant titles for the guidance of those with the fortitude to undertake a reevaluation of all aspects of the problem.

As a fact, it appears that at least certain aspects of all of these themes are younger than certain hints of the notion in stories left by early Chinese traders with the Roman West (Syria, etc.). They were the first to record the presence of a mysterious water sheep in that land that, as land-bound sheep do in other areas, produced a wool. It was, however, an even more desirable and rarer sort than wool produced by ordinary sheep.

For our part, it was Emil Bretshneider (both his names are variously transliterated and spelled) in 1871 who first noted that the strange 'water sheep' was evidently Pinna and its 'down' was Sea-silk. (I have not been able to see Bretshneider's rare original little tract but its conclusions are, I trust, adequately treated by such commentators as Laufer and Pelliot.)

Joseph T. Reinaud in 1863 missed only adding Pinna's name to the story to have put his name to a pioneering discovery in this regard. In his account of political and commercial relations of the Roman Empire with the Orient, he reported that in *Ta-thsin* (Syria) "is found ... the stuffs of a perfectly fine weaving that they say is made with the wool of a water sheep (or one that lives in marshy land). People name it (in China) 'stuff of the Western Ocean.'" Yet, Reinaud did know about Pinna and Sea-silk, for in his translation of the geography of Abulfeda (to be treated in my story of Sea-silk in the Moorish West), he related the fable of a beast that came up out of the Western sea and scraped a kind of wool off on rocks (clearly, the water sheep divesting itself of its umbilical cord of byssus fibers).

The story of the water sheep goes back at least to the second third of the 3rd century. From the *Wei lio*, as given in what I take to be an authoritative translation by Paul Pelliot, we learn that in a country called *ta-Ch'in* (the Mediterranean Orient – that is, the equivalent of modern Syria, at that time part of the extensive Roman Empire), "They have a brocaded (*chih-ch'êng*) fine cloth, for which it is said they use the down (*ts'ui*) of the water sheep (*shui-yang*), and which is called 'Hai-hsi cloth' ('cloth of the West of the Sea [kingdom]'). In that kingdom, the six domestic animals all come out of the water. Some say that they not only use sheep's wool (*mao*), [but] also use the bark of trees or the silk of wild silkworms to make [this] brocade (*chih-ch'êng*). Their *ch'ü-shu*, *t'a-têng* and [other textiles] of the class of woollen rugs (*chi*) and curtains (*chang*) are all good; moreover their colours are brighter than [the colours] of those manufactured in the kingdoms of the East of the Sea (Hai-tung)."

The passage here is ambiguous enough. Derivatives fare even less well. Hirth thought one version said that the fabric, although said to be made of the down of the water sheep, was in fact manufactured from cocoons of wild silk-worms, a translation with which Chavannes agreed. Laufer thought that the final statement was an independent clause and should read: "... and they also have a stuff made from wild-silkworm cocoons." However, Pelliot has it, correctly, I suspect, that this version is merely abbreviated from the *Wei lio* and reads: "They also have a fine cloth, which some say is made from the down

of the water sheep or the cocoons of wild silk-worms.”

I shall not cite the many variations of this theme. According to Pelliot, “in the whole of Chinese literature, there is only one mention of the *shui-yang*, that found in the *Wei lio*, in the middle of the 3rd cent. Later texts have been copied or abbreviated from it, and do not represent any independent tradition.” Further, Pelliot points out that there is the disquieting statement that the six domestic animals all come out of the water in a mythical land on the Western sea. When you realize that the *Wei lio* uses the word *shui-yang* (‘water sheep’) in one place and the single word *yang* (‘sheep’) alone is used another time, Pelliot suggests that “while admitting that there must have been in China, in the early 3rd cent., a tradition about some special sort of ‘sheep’s down’ of Ta-Chin, I think that we must be careful not to lay too much stress on the statement that this sheep was a ‘water sheep.’ ”

At the same time, there were abundant references to some sort of land-bound sheep that, like a plant, grew attached to the ground. Hirth put it: “There are lambs which grow in the ground; the inhabitants wait till they are about to sprout, and then screen them off by building walls to prevent the beasts which are at large outside from eating them up. The navel of these lambs is connected with the ground; when it is forcibly cut the animal will die, but after they have fixed the buds themselves, they frighten them by the steps of horses or the beating of drums, when the lambs will yield a sound of alarm, and the navel will be detached, and then the animal may be taken off the water-plant.” The latter lamb may be dubiously connected to the water-sheep per se, for they seem clearly to be land-bound, until the last phrase where they are again made to seem water-bound organisms. However, Pelliot notes that the story of a land sheep/lamb is virtually as old as that, just outlined, of the water sheep – and there are many more independent accounts of it, in contrast to the single notice (with echoes) of the water sheep.

Bretshneider (*Mediaeval Researches*) thought the vegetable lamb the source of a story of the lamb-plant, Tartarian lamb or Agnus Scythicus, first reported by the Friar Odoric in the fourteenth century (and quickly plagiarized by Mandeville), who however had them as a sort

of “great Gourds or Pompions, which being ripe, doe open at the tops, and within them is found a little beast like unto a yong lambe.”

Odoric’s tale here seems to indicate something more vegetable-like than strictly animal-like, and it may be that Henry Lee, for all the discredit heaped on his head, was right to see a connection between this fabulous account and a somewhat poetic account of the dehiscing of cotton bolls to reveal nothing more surprising than a wad of cotton lint. The problem seems to be that the tale itself was much older than the time of Odoric. This takes us far from Pinna and Sea-silk and I can but refer interested readers to the great account of Pelliot and the many works he cites. A somewhat elliptical account of the Scythian lamb, with excellent illustrations, may be found in a recent account of Engelbert Kaempfer by Robert W. Carrubba.

Gustav Schlegel thought that Lee was right to equate the Agnus Scythicus with the cotton plant but made much of his own notion that the camel was somehow involved. Despite his erudition, his findings have been given short shrift by Laufer, Needham and Pelliot.

Somehow, even the scaly (that is, rather bushily hairy) rhizome of a fern has been drawn into the variations on the theme of a sometimes-vegetable, sometimes-animal sheep. This appears to come into the picture by way of a mythical or merely poetic reference to the use of wool of the stillborn or unborn lamb (astrakhan). Eduard Bruckner and Emil Bretshneider (*Mediaeval Researches*) treated the matter of the fern and Pelliot has summarized the somewhat separate matters fully and satisfactorily. There is a quaint example of this strange ‘vegetable lamb’ in the botanical collection of Sir Hans Sloane (as reported by John Cannon), now somewhat divested by careless handling of its ‘wool,’ in the British Museum.

It is evident that there is an immense body of material that I have touched upon very inadequately. I refer readers to four 20th century accounts that offer more or less adequate introductions to literature on the matter. The writers are Berthold Laufer (1874-1934), Paul Pelliot (1878-1945), Kurakichi Shiratori (1865-1942) and Joseph Needham (1900-1995). Shiratori’s work on the topic is tangential to the problem of Sea-silk but offers new windows onto the past. He and

Pelliot seem to ignore each other. Both Pelliot and Shiratori benefited from Laufer's pioneering account and Pelliot, especially, has some cogent criticisms of it. Needham's short account hits only the high spots but is a useful beginning. I like Needham's observation that assumes the early Christian Era origin of Sea-silk fabrics: "Evidently the Syrian merchants lost no time in exporting this curious textile to China."

A final diversion is called for, that, in a way, gets us back on target, for there can be no doubt, as Pelliot has said, after careful evaluation of statements of Laufer and others (with some substantial hits), that the 'water sheep' of the *Wei lio* is Pinna. In a pretty legend, reported by Pelliot, Sea-silk seems to have come independently to the attention of the Chinese, but, as reported in the *Wu tu fu* of Tso Ssu (second half of the 3rd cent.), it was in an account of "the mermaid who weaves silk (... *hsiao*) in the depth of the sea. In the *Shu-i chi* ..., the mermaid is called ... *chiao-jên* ..., and the silk woven by her is ... *chiao-hsiao*, 'mermaid silk.' "

Now, here we have an example of difficulties that beset translators of languages. Without transliterating the idiographs that Pelliot has as '*chiao-jên*,' Friedrich Hirth and W.W. Rockhill, commenting on a 13th century geographic work of Chau Ju-Kua, had brashly translated the term as "byssus" - to the consternation of such a purist as Pelliot, for whom that word meant only a fabric made of plant fiber, or the fiber itself, never an animal product. Naturally, Hirth and Rockhill meant a cloth made of the byssus (as understood, however etymologically incorrectly, by biologists of their time) of Pinna, that is "Sea-silk, a conclusion, of course, with which Pelliot agreed.

While our interests must concentrate on Sea-silk, readers may follow the threads of separate fibers and fabrics, all seeming finally to lead to the inscrutable East. Hilda Ecsedy expounds on " 'Böz,' an exotic cloth in the Chinese Imperial court." W.T.M. Forbes accounts for some ambiguous references to silk in the West (Aristotle did not know silk of the domesticated Oriental silkworm). There are good summary histories of byssus (not Sea-silk!), cotton and silk in R.J. Forbes's comprehensive studies of ancient fabric technology.

E. Handschin's history of silkworm silk will prove interesting, since awareness of Sea-silk is evident. András Rona-Tas has written a deep work on the difficult matter of the semantics and phonetics of the word *böz*, somehow interwoven in the cultural history of *byssus*. The history of the silk trade by J.E. Vollmer et al. contains interesting allusions to knowledge of silk in the West. For a modern history of Old World cottons, start with Andrew M. Watson's careful account.

References

Abulfeda (1273-1331); his account is from Istakhri; see translation of Abulfeda's 'Geography' by J.T. Reinaud and S. Guyard, 2(1): 242.

Bretschneider, Emil, *On the Knowledge Possessed by the Ancient Chinese of the Arabs and Arabian Colonies*, p. 24.

Bretschneider, Emil, *Mediaeval Researches from Eastern Asiatic Sources*, p. 154, references to both Odoric and to the fern *Cibotium barometz* Linn.

Brückner, Eduard: "Das Pflanzenschaf (Baranetz)."

Cannon, John, "Botanical collections," pp. 146-147, in A. MacGregor, *Sir Hans Sloane*; the vaguely zoomorphic 'body' of the lamb is formed by the fat rhizome and it is turned upside down and provided with 'legs,' by retaining four strategically placed and appropriately trimmed leaf stems.

Carrubba, Robert W., "Engelbert Kaempfer and the myth of the Scythian lamb."

Chau Ju-Kua (13th century), *His Work on the Chinese and Arab Trade in the Twelfth and Thirteenth Centuries*, pp. 141, 142; see also Pelliot, 1: 530.

Chavannes, Edouard, in an account of "Les pays d'occident d'après le Heou Han Chou," in *T'oung Pao*, gives a somewhat garbled reference to the Chinese term *shui-yang-ts'ui*, which he thought Bretschneider correct in identifying as Pinna's Sea-silk; see pp. 183-184; see Laufer, p. 111.

Ecsedy, Hilda, "Böz - an exotic cloth in the Chinese Imperial Court."

Forbes, R.J., *Studies in Ancient Technology* (vol. 4, 2nd rev. ed.), has not the slightest reference to Pinna but gives excellent accounts of *byssus* (pp. 43, 76), *cotton* (pp. 43-49), *silk* (50-ff).

Forbes, W.T.M., "The silkworm of Aristotle," a good piece of scholarship that brings biology into philology; his warning (p. 22, f.n. 2) that one needs to distinguish between references to true silk and "mere citations of transparent textiles" might be a model warning for students of Pinna's Sea-silk!

Handschin, E.; a long article on "Silk Moths" includes, among other parts, one on "The silkworm or *Bombyx mori* Linné" (pp. 1902-1907), and one on "Spiders and insects as producers of silk" (pp. 1925-1929); he alludes, finally, to "Mussel silk" on p. 1935.

Hirth, Friedrich, *China and the Roman Orient*, gives several versions of the 'water sheep' story, all of which Pelliot (1: 507-508) derives from one original and rather ambiguous account; for its date (1885), it was an ambitious and important work.

Laufer, Berthold, "The story of the Pinna and the Syrian Lamb"; one of the greatest accounts of the story by a great scholar; while Pelliot (1: 507-ff) respectfully convinces one of certain faults, it remains a seminal work deserving of wide acquaintance.

Lee, Henry, *The Vegetable Lamb of Tartary*; while many people carp at details, some of his conclusions were sound and he did dispose of some nonsense; Laufer and Needham were entirely negative but see Pelliot (1: 507, etc.).

Needham, Joseph, *Science and Civilisation in China*, vol. 1, "Byssus," pp. 200-202.

Odoric, Friar; see his account of the Orient in R. Hakluyt's *Principal Navigations*, etc., vol. 4: 370-408 (Latin), 408-444 (English); the reference to the lamb-from-a-melon is, in English, on p. 435; Pelliot treats Odoric extensively, 1: 522-524; see also Henry Yule.

Pelliot, Paul, *Notes on Marco Polo*, 1: 509-510, and elsewhere; many pages in his account of 'Cotton' are pertinent.

Reinaud, Joseph Toussaint, and Stanislas Guyard, *Géographie d'Aboulféda*.

Reinaud, J.T., *Relations Politiques et Commerciales de l'Empire Romain avec l'Asie Orientale*, pp. 202-203.

Rona-Tas, András, "Böz in the Altaic world."

Schlegel, Gustav, "The shui-yang or watersheep in Chinese accounts from Western Asia and the *Agnus Scythicus* or vegetable lamb of the European mediaeval travellers"; many learned citations but fellow workers have not been kind to him.

Shiratori, Kurakichi, "A new attempt at the solution of the Fu-lin ... problem"; see references to the water sheep, etc., beginning p. 202.

Vollmer, John E., et al., *Silk Roads / China Ships*.

Watson, Andrew M., "The rise and spread of Old World cotton," pp. 355-368, in: Veronika Gervers, ed., *Studies in Textile History*.

Yule, Henry, *Cathay and the Way Thither*, 2: 240-243, Odoric's story of the melon-lamb.

A Western Splinter: The Arabs In Spain And Northern Africa – The Water Sheep, Part Two

The history of Pinna and Sea-silk among the Moors in Spain and their fellow Arabs in northern Africa is a study of mysteries. What little is known about Pinna's early history in the area of Greek-Roman Syria and Egypt has been explored in a previous chapter and will not be repeated.

I do not imply that this story begins with the origin of Muhammedanism in the seventh century, for Arab traders must by then already have been acquainted with some aspects of it. Quite possibly, their knowledge of Sea-silk was older than the fable of a water sheep that the Chinese imported from Syria. There is uncertainty, in fact, in regard to the age of the story of a water sheep among the Arabs. What can be said is that the Arabs took as seriously as the Chinese the stories they heard – and just as frequently and faithfully repeated them. And as with the Chinese, a good many skeins of this story go back to very few original sources and there are many lacunae.

As murky as the early history of Pinna and Sea-silk in this region may be, its later history was, until a mere century and a half ago, even more of a void. The great list-makers of early Western natural history simply did not think of the Arab world as relevant to Pinna. With the study of Arab sources by German and French students in the 19th century, the Arabs' notions of Pinna's story began to

unfold. By 1882, Josef Karabacek was able to twit Arab scholars for their romantic acceptance of a fable; at the same time, he showed that students of German poetry had not kept up with the times. Referring to Classical and Arabian authors, he dwelt at length on the history of Sea-silk among the Arabs, then pointed out that the "salamander" fabric of German poets was neither salamander skin nor asbestos but Pinna's Sea-silk. The reference, in fact, was not to its unburnability (whence guesses as to its being made of asbestos were derived) but to its unique 'burning' color.

As for the most ancient past, I think it is clear that people there did not know how to utilize Pinna's Sea-silk in making a fabric. As already pointed out, Theodor Reil's study of the entire range of textiles in the Egyptian papyri failed to turn up any identifiable reference to Pinna. Gustav Schaefer's account of ancient weaving and fibers is equally negative. R. Pfister was convinced that Sea-silk was unknown in Roman Syria.

I am unconvinced by Stephanie Dalley's effort to put Pinna and Sea-silk so near the middle of the stage in ancient Assyria. How can you bridge a time span of many centuries and equate a wealth of Assyrian textiles with a few early Christian reports and a bit of weaving found in a late Roman-age grave in Hungary? Where did the Assyrians acquire their seeming super-abundance of Sea-silk? "Large quantities" certainly is no true measure of the amount of Sea-silk that could be harvested, even in the best of times, in the Mediterranean. And her statement that "Fishermen collected the brilliant, lustrous fibre in large quantities by twisting and breaking it off the mollusc with a long-handled fork or trident," leaving the mussel unharmed and free to grow a new beard, is ludicrous. Whatever else one can say about the absence of archaeological examples, it is *not* because there is no harvest of shells, with a resulting lack of shell middens! The animal is inevitably destroyed in the process of harvest: and the amount of Sea-silk that is laboriously harvested and processed has, since the earliest modern times, been far from enough to support a settled industry. (See also my note on Winifred Needler.)

It may be that we shall one day turn around this inclination to identify as Pinna's Sea-silk any fabric that has been uncritically called

'byssos' (or cognate word that is assumed to be Sea-silk). Patricia L. Baker, for example, has perhaps over-enthusiastically supposed that an ancient fabric with a lovely gloss *may be abu qalamun* (or *kalamun*), an Arabic name now generally associated, perhaps sometimes uncritically, with textiles made of Sea-silk. It may be, in fact, that, as with 'byssos,' the Arab term *abu qalamun* has become a 'buzz word,' where a wide variety of fibers end up under the same name for various reasons, not all of them applicable to a fabric made of Sea-silk. Some reports have *abu qalamun* as showing an almost unearthly iridescence – but Pinna's Sea-silk is not iridescent. Neither, so far as I know, have the examples of it that Baker cites been critically examined by biochemists. (In fairness to Baker, it has to be said that claims that *abu qalamun* actually is Sea-silk require documentation, so far lacking.)

In regard to claims that *abu qalamun* is a highly iridescent material, Berthold Laufer pointed out that such references may be to a cheap, garish substitute for Sea-silk, somehow incorporating glossy (and truly iridescent) bird feathers into a finished weaving. Further notice of the use of iridescent feathers will be given at the end of this chapter. (There is a troubling reference to a North African term transliterated by Alfred Bel and P. Ricard as *bû-qalmûn*: it is used to describe a way of carding wool into a flat mass that can then be rolled upon itself.)

By our time, it is possible for R.B. Serjeant, in an excellent work on Islamic textiles, to provide a connected and coherent, if somewhat circumstantial, history of what he refers to as "Sea-wool." Several useful references to Sea-silk among the Arabs are to be found in works by Georg Jacob, Henri Silbermann, S.M. Imamuddin and Maurice Lombard.

Along with these works, there are those that offer tidbits merely, often useful, as well as those for which Sea-silk is, quite unrealistically I think, to be found on every side.

At the opposite extreme, Johann H. Chemnitz, in 1777, a major contributor to a modern natural history of Pinna, did not mention any knowledge of Pinna or Sea-silk among the Arabs or the Chi-

nese. It is sobering to note that there are still fairly comprehensive accounts, relevant to the region in question, that totally ignore the subject of Sea-silk. See the account of Moorish silks and other fabrics by W.F. Leggett and the catalog of an exhibition of Egyptian (and other Arab) fabrics from the Bouvier Collection (Anon., 1993).

What we must deal with in this chapter is a folk phenomenon. It is not merely the matter of fabrics that can be taken to be Sea-silk. These probably go right back to early centuries of the Christian Era when people in the Mediterranean basin, to the delight of the early moralists, began to weave such cloth. Just when the Arabs first heard the story of the water sheep is unknown. The regularities that we shall meet in its regard turn out to be a product of a much later period. These later Arabic accounts of Pinna, with all their intimations that we are dealing with a variant of the water sheep of China and Western Asia, cannot be proved to have ancient roots. It shows up, nearly full-blown, about the 10th century, as Paul Pelliot has noticed.

To prove that there were Pinna mussels present in Spain, where much of our story centers, we may cite Joaquín González Hidalgo y Rodríguez, who lists three species of the genus for the Iberian Peninsula: *Pinna fragilis*, *P. nobilis* and *P. pernula*, with only the second qualifying as ever really abundant. I was surprised to find that the sophisticated zoological account of Hamdullah al-Musta'fi al-Qazwini contained no reference to anything that can be Pinna. It was not, of course, a work exclusively connected with Mediterranean culture.

Adam Mez has described, in his learned account of advances in Islamic technology, the various fibers used, and the resultant fabrics, from celebrated fine wools, to linen cloths, some extremely tough, some very thin but weighted down with gold so that they were quite costly and their export might be forbidden. There was also "a loose sort of linen fabric 'comparable to a sieve,' called *qasab*. ... Further, in the 5/11th century a new speciality came in, *Abu Qalamun*, an iridescent material, exclusively manufactured in Tinnis [in Egypt]." He notes: "The authors of the 4/10th century do not speak of this in connection with Egypt" – that is, it was new there in the 11th

century AD.

As for the term *Abu qalamun* (or *Abu kalamun*), H.L. Fleischer supposed it to be derived from the Greek *opochalamon*, some sort of striped cloth (that is, brightly marked or colored, not necessarily iridescent). For a full account of the term, see both the *Encyclopédie de l'Islam* and *The Encyclopaedia of Islam* (under *Abu Kalamun*). An undated Egyptian trade dictionary, used in the luxury trade, and translated by Charles Pellat, put it: '*Abu qalamun* is a weaving of imperial Byzantium, a deep red with diverse rays of violet on red and green. It is pretended that its color varies with the time of day and the intensity of the sun, its price is very high.' And again: *Abu qalamun*, 'an iridescent woven material from Byzantium.' Now, perhaps a color 'that varies with the time of day and the intensity of the sun' can be thought of as iridescent; equally, one can imagine that a fabric made of Sea-silk might be dyed in various glorious colors – but both characteristics make one wonder if Sea-silk could have been involved in their manufacture. It is not iridescent and, if we think its major value inhered in its native color (as the over-used term 'cloth of gold' implies), it was not regularly dyed. We shall have reason to return to these difficulties.

In Charles Pellat's translation of *Description de l'Occident Musulman*, by Muhammad ibn Ahmad al-Muqadisi (b. ca. 946; the work was written to cover the 4th through 10th centuries), there is an account of the *Fât'imide* empire, to the borders of the province of Damascus, where one finds many curiosities. Among them is '*abu qalamun*, a beast that, on the edge of sea, rubs itself on rocks and makes thus to come off hair that has the suppleness of silk and the color of gold. People are careful not to lose any of it because it is rare and precious. One collects it and weaves it into cloth that, in the space of some hours, takes on various colors. The ruler forbids its export, but for what is passed along secretly. A garment tailored of this fabric attains sometimes up to 10,000 dinars.' Possibly, reference here is to the smuggled, black-market fabrics. In his footnotes, the translator identifies the 'beast' as the 'Pinne or Jambonneau, a genus of mollusks of which the byssus is used to make fabrics.' Further: the sum of 10,000 dinars he calculated to represent 'more than

4 kg of gold, and would be about 1,250,000 gold-francs in 1914: this price seems exaggerated!' (As a matter of fact, it appears that there may have been an error somewhere; the figure given by most authors is one thousand dinars - a substantial sum, nevertheless.)

Now, for various references to a textile presumably made of Sea-silk, known and prized among the Moors in Spain. In his translation of Ahmad ibn Muhammad al-Makkari's history of Moorish Spain, Pascual de Gayangos described the rich gifts apportioned by the Arab general al-Mansur to his supporters in 997. To them, according to their ranks, he gave 2,285 pieces of silken stuff called "*tirazi*," of various colors and patterns; 21 dresses of "seal-skin" (which Gayangos quaintly admits he derived from words that were originally 'wool of sea-monsters'! - it is our old friend, the water sheep or, of course, Pinna); 2 dresses of the stuff called *anbar* (a substance that Gayangos considered to be amber - and, naturally, could make no sense of it, although see below the stab at identification made by Fagnan!); 11 of scarlet cloth; 15 *marishat*; 7 horse-cloths made of brocade; 2 dresses of the same stuff manufactured in Greece; and 2 others lined with weasel-skin (Gayangos supposes this from a mammal of the rat tribe but I should think it ermine or possibly miniver, the belly pelt of the European red squirrel, once a highly prized fur, as Staniland reports). (Gayangos spells out numbers of garments awarded; thus, there can be no doubt about their relative ranking.)

E. Fagnan's translation into French of *Histoire de l'Afrique et de l'Espagne intitulée al-Bayano-l-Moqrib*, by Ibn 'Idari, al-Marrakushi, recites the same list of articles, with slightly different, although not altogether much improved, identifications. In addition to 2,285 pieces of silk brocades, there were 21 garments of "Sea-wool (*laine marine*)," thus correctly identifying the "wool of sea-monsters." However, he stumbled badly on 2 garments of '*anberi*,' which he identified with Dozy, an early editor of the Arabic text, as "a work of fur of the sperm whale (*cachalot*)"! This might, I suppose, be the fur of the now rare Mediterranean monk seal - but why it would be referred to as "amber," unless a color was meant, I cannot imagine.

In his shortened, popular history of *Spanish Islam*, Reinhart P.A. Dozy reported merely that, at the end of the campaign al-Mansur

"took leave of his allies ... not without conferring on them rich gifts consisting for the most part of costly fabrics," thereby submerging all diversity.

From a rich store of memoranda found in the Jewish community in the Cairo Geniza and handsomely presented by S.D. Goitein, we learn that some time in the 10th through 13th centuries, someone requested, in a large order of precious textiles, "one for two covers of sea wool, each twenty-four cubits long and woven together with green and red silk." (If the cubit used was the usual unit of length of around 20 inches, these were covers of an impressive length!) Goitein carefully distinguishes the luxury fibers of that time and refers to "A fanciful material ... 'sea wool,' made of threads produced by a large marine mollusk, which have a golden luster and take on various colors during the day." Considering the number of other fabrics, including diaphanous ones, requested (and carefully characterized by Goitein), 'sea wool' was rarely enquired for.

For an early reference to what may be called a 'water sheep' as well as to a precious fabric made from its 'wool,' we are indebted to Istakhri (fl. 10th century - Laufer cites a date of ca. 951; few biographical details are known). In Reinaud's translation of Abulfeda's 'Geography,' Istakhri wrote (I use Laufer's translation): "At a certain period of the year an animal is seen running out of the sea and rubbing itself against certain stones of the littoral, whereupon it deposes a kind of wool of silken hue and golden color. This wool is very rare and highly esteemed, and nothing of it is allowed to waste. It is gathered and serves for the weaving of tissues that are now dyed in various tinges. The Ommayad princes who then ruled at Cordova reserved for themselves the use of this wool; only surreptitiously a small portion of it may be abstracted. A robe made of this wool costs more than a thousand gold-pieces." (Serjeant, using the original Arabic, makes the price a hundred dinars; since everybody spells out the words, there is no possibility of a simple typographical error with numerals; Chavannes takes his version from Reinaud.)

From approximately the same era in the Arab world, there are two other references to *abu qalamun* (or 'bouqalemoun,' as Shefer transliterates it): one, a note from a traveler, Nasir-i Kusraw (fl. 1035-1042);

the other, a more generalized account of the role of that fine fabric in Moorish life in Spain.

In Nasir-i Kusraw's record of his travels during 1035-1042, he reports on the region of Tinnis and other localities in Egypt. There are many detailed accounts of fabrics and fibers and he noted: 'It is also at Tinnis and nowhere else, the people make stuffs called *bouqalemoun* in which the colors change according to different hours of the day. People export it through the lands of the Occident and the Orient. People have told me that the emperor of Greece had offered 100 towns to the Sultan on the condition of receiving Tinnis in exchange. The Sultan rejected the proposition. The desire to possess the town that produced *qaçab* and *bouqalemoun* had inclined the emperor to make that request.'

And, in another passage on Tinnis, 'Qassab [same as *qaçab*] and *bouqalemoun* made for the sultan are paid for at their fair value; the workers carry on therefore with pleasure for him, contrary to what goes on in other lands where government and ruler impose forced (statutory) labor on artisans. One weaves *bouqalemoun* into the blankets [coverlets] of litters [such as people are carried on, etc.] that people put on camels, and saddle blankets destined to the particular use of the ruler.'

In an enthusiastic account of pomp and ceremony in the sultan's life, in the town of Misr, in Cairo on the Nile, the sultan, his entourage and their rich dress and trappings are minutely described. There was a grand pavillion (tent) of satin of Rum, covered by embroideries of gold and strewn with stones. All the furniture inside was covered with the same material. 'A hundred men were able to shade themselves within this canopy; it was preceded by a passage [a covered walkway?] made of the material of *bouqalemoun*' In regard to the horses that were part of the ceremonial parade (they had been inured to the noise by three hours of beating of drums and the playing of trumpets), 'the saddle blankets were of satin of Rum and of *bouqalemoun* that were woven on purpose: that is, they were neither cut nor sewn.'

Further: 'People make at Misr pottery of all kinds; it is so fine and so diaphanous that one sees through the side of a vase, that hand that is put on the inside. People make some of it decorated with colors that are like those of the fabric called *bouqalemoun*: the hues change according to the position from which one views it.' (This certainly indicates an iridescent quality, such as one sees in many Tiffany glass objects.)

At a lavish party given by the Sultan, 7 March 1049 (so printed, but 1038 is meant), there were twelve pavillions, joined to one another and forming a square. 'When people entered in one, they found it to be more beautiful than the one they had just left. Each [pavillion] had a surface of 100 *arech* square, with the exception of one only that had only 60. In this last was raised a throne occupying all of the width of the room; it had four *guez* of height and the same of width. ... The carpets and the hangings of this were in satin from Greece and in *bouqalemoun* woven especially to the measure of the place where they were meant to be placed. One railing [balustrade] in lattice work of gold surrounded the throne of which the beauty defied all description.' Etc.!

In his learned study of the significance of materials to ceremonial life in Moorish Spain, Henri Pérès studied Arab poetry as sources of information. In celebrating the Day of *nayruz*, 'one offers valuable gifts. Thus, Ibn 'Ammar gave to al-Mu'tamid a suit of marine silk (*suf bahri*)' (Pérès says this is also called *abu qalamun*). (The gift may have been simply a textile, not necessarily finished clothing.) That material was then, Pérès says, considered 'an alga [!] of great rarity.' The vicinity of the Portuguese (then Spanish) town of Santarem (variously spelled) is indicated – a locality often mentioned in regard to *abu qalamun*.

Although some textiles were imported, Pérès writes, many were fabricated in Spain; evidently among them were 'Weavings with reflections of gold or *abu qalamun* (*lana marina, suf bahri*), made of filaments of a marine shell that one gathers on the coast of the Atlantic in front of Santarem [among authors cited, some have it also at Tinnis, in Egypt]; it is made in Andalusia' (he repeats the account of its being used as gifts on a feast day). While this is more smoke

than fire, it does tend to indicate the value placed upon what people understood as *abu qalamun*.

The Moorish writer, al-Idrisi, who lived about 1100-1166, is reported to have left some notice of Sea-silk in his 'Description of Africa and Spain.' Imammudin (1963) seems to have garbled his references when citing this work as a source of something on *abu qalamun*. There is some reference to the weaving of fine carpets in the city of Chinchilla and it is possible that the following is of interest. On page 21, there is an annotated list of fishes, including: "The water sheep (*faraso l'mâ*) resembles a sheep in appearance, but it is small and has feet like those of a duck; it contracts [or retracts?] these when it wants to raise them; and opens them up when it lowers them; it sports a long tail." Strange!

Yaqut ibn 'Abd Allah al-Hamawi (?1179-1229), in a work that seems unavailable in a Western language, is said by Serjeant to credit the inhabitants of the city of Saragossa with being "skilled in the manufacture of the sable (*sammur*) which he seems to think is a woven stuff made in their factories and called *Sarakusti*" [after the city]. Serjeant thinks he refers to Sea-silk, since a similar story comes from Makkari (to be cited shortly).

Abd Allah ibn Ahmad, called Ibn al-Baitar (or Baytar) (d. 1248) left several interesting references to Sea-silk and associated matters. His account of *Souf el-bahr*, product of Pinna, is as follows (from Lucien Leclerc's French edition): 'The book called *er-Rihla* [reports]: Certain people maintained in olden times that this is a species of marine lentil [this, I suppose, is an alga] that grows on rocks of the bottom of the sea, but this is an error. It is in reality a substance that one finds in the sea of the Levant and in the sea of the Romans, as well as in the bottom of the sea of Sfax, town of the territory of Kairouan. One finds it the most abundant in the vicinity of Kaar Ziad and in the neighborhood of Kabboudiya [Tunisia]. It is contained in a shell, big as the hand of a man, broad at the upper part, terminated in a point and of a rather lengthened form, resembling the beak of a bird. Externally the shell is rough and furrowed by ridges prominent and angular which correspond to the cavity inside [he means, I think, that the shell is fluted; this affects, in opposites, outside and inside]; these

ridges are narrow and sometimes long as a plume for writing. The color of this shell is that of the shell that supplies pearls. Internally, it is of a yellow color of an agreeable aspect and tending to red. The shell encloses an animal composed of parts that resemble sinews [or, perhaps, muscles or even 'flab']. The liver of this animal is white, and the intestine black, and at the place where the intestine ends, toward the point of the shell, is found this wool, one of the admirable creations of the Divine. The inhabitants of the regions where one fishes for this shell have told me of an animal, a crustacean, that thereby takes over and pierces [?] in the lower region where the wool comes out; that it throws itself above and nourishes itself on [or by] it, to the exclusion of the whole rest of the animal.' Joseph von Sontheimer's edition of this has the final sentence a bit different and refers to the fact that the mussels must be pursued in the most remote seas (intimating that catching them is not easy). He thought they were often caught only for the byssus, perhaps wondering why they were not eaten.

Zakariya al-Qazwini (about 1203-1283) repeated a somewhat familiar story, but localized the action at Santarem. I have this only in Laufer's translation: "One of the wonders of this sea is what is told regarding a certain animal which there comes out of the water to rub itself on the shore, whereby its hair falls out; these have the color of gold and the softness of *khezz*. These are rare and highly esteemed, for which reason the people gather them and weave them into clothes. The kings prevent their exportation, which can be done but secretly. The value of a garment amounts to more than a thousand gold-pieces owing to its beauty and rarity."

Makdisi [Maqdisi] adds little to this account; the area is the Maghreb including Spain; he gives the name of *Abu Qalamun* to it; fabrics woven from it take on various colors during the day (taken from Laufer and Serjeant).

As with Yakut, so Makkari continued to be confused about the source of *Abu qalamun*. As Serjeant puts it, citing a source from the early 12th century, Makkari wrote: "The *sammur* (sable) from the down of which the valuable furs are made, is found in the Atlantic (al-Bahr al-Muhit) in Andalus in the direction of the island of Britain, and

imported to Saragossa where it is manufactured.” Serjeant thinks Makkari here referred to the seal but notes elsewhere that he quoted another author and came up with the statement that “this above-mentioned sable” was unknown to him and he could not decide if it were plant or an animal. “If it is the known animal it is in the sea and comes to the land. It has great power of distinction” (a statement that many a savant must have puzzled over!). There seems no doubt that both he and Yakut referred to Pinna.

An Arab traveler named Mohammad ibn Ahmad al-Tidjani (or Tidjani) (fl. about 1309) left in his account of “Ifrik’ia” (Tunis), with reference to the city of “Sfak’s” (Sfax) and its sea and shore, the notice: ‘One finds in its seas marine wool [laine marine], of which people make fine weavings destined to be sent to princes; people assure me that in the same place one sometimes fishes up oysters containing pearl.’

The account of Ibn Fadl Allah al-’Umari, Ahmad ibn Yahya (1301-1349), translated by Serjeant, provides a final notice. A French version of 1927 differs from the following in how words are transliterated from the Arabic. It also has additional material on notable fabrics made of silk, cotton and wool (sometimes mixed), including some of extremely fine wool. “The Sultan (of Ifrikiya), according to Ibn Bannun, is distinguished from other people by wearing garments of khazz-silk of a black-green [or dark-green] color named nut-colored (Djawzi), dust-colored (ghubari) and Nafti (from the town of Nafta). This silk is extracted from the sea, says Ibn Sa’id, at Safakus in the Maghreb and I have seen how it is gathered. Divers dive into the sea and bring out tubers like onions with a kind of neck which has hairs on the upper part. These tubers like onions, burst, and let forth hairs (threads) which are combed and become like wool. They spin it and make a woof of it so as to pass a warp of silk through it. They make a checked (mukhattam) stuff or stuff without checks. The most magnificent garments at Tunis are made of them. The price of a garment sometimes reaches a thousand dinars of Egyptian or Syrian money. I may add that I have seen high secretaries of the offices of Damascus wearing those garments, then I saw them worn at Cairo by the secretaries. It is what the Egyptians call fish-down

(wabar al-samak).”

It will be noted that, in some ways, knowledge of the biology of Pinna had not been much advanced by the passage of time.

Laufer concluded that the extreme rarity and cost of *abu qalamun* led to the use of iridescent birds’ feathers as constituents of a cloth. Laufer, correctly, it seems to me, countered notions that fabrics made of Sea-silk are iridescent, if one means the kind of changing visual delight furnished by light playing on tail-feathers of a peacock.

Now, Qazwini opened his chapter on ornithology with a description of a bird styled *abu baraqish*, said to have a plumage that “every hour ... glitters in another color – red, yellow, green, blue.” Laufer thought *abu baraqish* a fictitious bird, invented to account for the iridescent (etc.) characteristics mistakenly attributed to *abu qalamun*. Patricia L. Baker, however, describing the latter from literary allusions, compared its iridescence to the feathers of peacocks and especially the Nile marsh bird, the sultan fowl (*Porphyrio porphyrio*), a bird somewhat like the North American purple gallinule (*Porphyryula martinica*). Citing a *Supplement to the Encyclopaedia of Islam*, she claims that it is (or was) given the Arabic name of *abu barakish* (as spelled there). These swamp birds (of the rail family) are handsome but hardly magnificently or iridescently colored.

F. Viré’s account of *abu barakish* in the *Supplement to the Encyclopaedia of Islam* is actually more complex than Baker allows. The term itself is a name “no longer in use.” (This seems abundantly proved by reference to works by Patrick F. Houlihan and Steven M. Goodman and Goodman et al.) It is given, “according to localities, to two birds whose brilliant plumage is characterised by iridescent colours or [the ‘or’ requires emphasis!] shows a colour-scheme varying in the course of the seasons.” The first name is “According to the uniform definition provided by Arab lexicographers, the true *abu barakish* ... ‘a small bird of the bushes with a greyish head, a scarlet breast and dark lower parts. Just like the porcupine, when excited it ruffles up all its plumage, showing a whole range of glittering colours.’ ” The author concludes that there can be no doubt that the bird meant is a male weaver-finch (family Ploceidae), the

flame-coloured Franciscan or Grenadier, *Euplectes oryx franciscana*, in its gorgeously colored but short-lived nuptial plumage. This sometime brightly colored bird is, of course, quite removed in size from the sultan fowl and the emphasis here is upon bright colors only, with perhaps a secondary reference to seasonal changefulness (for the species is dull and drab in the nonbreeding season).

However, Viré reports, the second name comes from the authority of al-Kazwini (Qazwini), who *alone* accounted the *abu barakish* to be “a wader with a pleasant-sounding cry, with red beak and feet, of a size close to that of the stork [!] and with plumage fluctuating in colour, in reds, greens, yellows and blues.” Well, aside from size, perhaps this is indeed *Porphyrio*, the sultan fowl. For whatever reason, al-Kazwini chose to emphasize iridescence (that is, the color depended upon the angle of view or of incidence of light rays, etc.) – and did his best to pick a bird whose feathers supplied that feature. But consider further that Viré writes: “The livery of this attractive wading-bird apparently provided Byzantine weavers with the inspiration for the creation of the precious dove-coloured shot silk called *abu kalamun*, a name which conversely was applied to the bird.” Who, under these circumstances can be sure that *abu qalamun* was made of Sea-silk, much less that it was iridescent? Brightly colored (“reds, greens, yellows and blues”), well enough: but what about “dove-coloured”? But if we get back to Sea-silk, as Laufer did, we find it not iridescent and its color best left alone, if we are to believe the early Christian scribes.

I might point out a further complication. If *abu barakish* is the weaver-finch named above, its distribution in no way includes the Mediterranean shores or even Egypt at all, as can be seen in any of several African bird manuals. Qazwini's upstart *abu barakish*, the sultan-fowl or gallinule, certainly is distributed widely in Egypt and along the Mediterranean shore of North Africa, as may be noted in Houlihan and Goodman and Goodman et al. These distributions are clearly shown in R.D. Etchécopar and François Hüe's account of birds of northern Africa; incidentally, they give the Spanish common name for the gallinule as “Calamón común”; Goodman's lists of modern Egyptian names do not include anything like *abu kalamun* or *abu*

barakish.

This does not mean that there was not an interest in glossy or iridescent and brightly colored textiles. There probably was.

With regard to feather-fabrics, it is to be recalled that the 13th century Chinese geographer, Chau Ju-kua, spoke of highly esteemed fabrics of great beauty that incorporated iridescent kingfishers' feathers – and, in accounting for the rarity of their feathers and the textiles, incidentally penned what must be one of the earliest descriptions of territorial behavior in birds.

References

Abd Allah Ibn Ahmad, called Ibn al-Baitar, *Traité des Simples* (Lucien Leclerc, 1877-1883), a storehouse of medical lore; 2: 386-387, #1423; Sontheimer's version, 2: 141; see also Laufer, p. 119.

Abulfeda, *Géographie*, 2(1): 242, f.n. 1, a long rambling editorial note, quoting Istakhri, so this is not really Abulfeda's work at all. *al-Baitar*: see Abd Allah Ibn Ahmad.

Anon., 1988, *Tissus d'Égypte Témoins du Monde Arabe*; note total absence of any reference to Sea-silk in an account of over 200 choice examples of early fabrics.

Baker, Patricia L., “An Abbasid silk fragment,” a good account of *abu qalamun* and its reputed iridescence; whether the piece in question is really Sea-silk needs biochemical evaluation.

Bel, Alfred, and P. Ricard, *Le Travail de la Laine*, p. 25.

Chau Ju-Kua, *His Work on the Chinese and Arab Trade* (12th and 13th centuries), pp. 235-236; while referring only to China, his account of luxuriant feather fabrics is worthy of notice; his account of territoriality in kingfishers is excellent: the feathers “are got in great quantities in Chön-la where (the birds) are brought forth in nests built by the side of lakes or ponds in the depths of the hills [that is, in holes in the banks]. Each pond is the home of just one male and one female bird; the intrusion of a third bird always ends in a duel to the death. The natives, taking advantage of this peculiarity, rear decoy birds, and walk about with one sitting on the left hand raised. The birds in their nests noticing the intruder, make for the (bird on the) hand to fight it, quite ignoring the presence of the man, who, with his right hand, covers them with a net, and thus makes them

prisoners without fail.”

Chavannes, Edouard, an account of the Chinese historian Heou Han Chou, in *T'oung Pao* (1907), pp. 183-184, a notice of Istakhri's account of the water-sheep on the western coast of Spain.

Chemnitz, J.H., “Abhandlung von der Steckmuschel und ihrer Seide.”

Dalley, Stephanie, “Ancient Assyrian textiles and the origins of carpet design”; see p. 121, where it is assumed that on the basis of a modern dictionary definition (and only part of that) one can intone that “technically speaking,” ‘byssos’ is exclusively an ultra-fine fabric woven from silky filaments secreted by Pinna, etc.; the mistaken account of harvest, where the animal is allowed to go free and grow a new byssus tuft, is on the same page; there is more, with an abundance of references to relevant literature, on pp. 122, 134.

Dozy, Reinhart P.A., *Spanish Islam*, p. 520; the reference simply lists gifts of fine fabrics without giving kinds.

Dozy, R.P.A. *Supplément aux Dictionnaires Arabes* (1927), 1: 853, under what he calls (in Arabic) *Suf al-bahr*, citing al-Baitar, Istakhri and others.

Encyclopédie de L'Islam (1913-ff.), *Abu kalamun*, 1: 96; at present, this is the usual Persian designation of the chameleon, although rarely so used by Arabs. “The philosophers ... knew *abu kalamun* nearly exclusively as a fabric delicately shaded with various colors, introduced into commerce by the Byzantines.” One authority knew it “only as a fabric woven in the colors of the *abu barakish*,” a bird with iridescent plumage (see P.L. Baker; B. Laufer; F. Viré).

Encyclopaedia of Islam, new ed., *Abu kalamun*, 1: 131; several references cited are to Arabic documents of which there are no translations into European languages; we get off onto chameleons, brightly colored birds, metallic stones and what-have-you; see also *Supplement, abu barakish*, Fasc. 1-2: 19-20, 1980; article is by F. Viré.

Etchécopar, R.D., and François Hüe, *Les Oiseaux du Nord de l'Afrique de la Mer Rouge aux Canaries*; see frontispiece map; pp. 191, 600.

Fleischer, Heinrich Leberecht, *De Glossis Habichtianis*, p. 106; derives *Abu kalamun* from the Greek word ‘*opochalamon*,’ a striped (hence, gaudy?) cloth.

Gayangos, Pascual de, *The History of the Mohammedan Dynasties in Spain*, from a book by Ahmad ibn Muhammad al-Makkari (d. 1631); 2: 195-196, the list of rich garments given to supporters, some of them Christian, of al-Mansur in 997, quaintly mistranslating ‘wool of sea-monsters’ as fur or skins of seals.

Goitein, Solomon D., *A Mediterranean Society*, 1: 105-106, note 40, p. 419; a delightful work, full of detailed information.

Goodman, Steven M., and Peter L. Meininger et al., eds., *The Birds of Egypt*, pp. 222-223; I am grateful to Dr. Goodman for his comments on the absence of *abu barakish* as the Arabic name of a modern bird.

Hamd Allah, Mustawfi Qazvini (fl. 1330-1340), *The Zoological Section of the Nuzhatu-l-qulub*; my search for ‘Qazvini’ (or related name) led me to this; he is not the man but his zoology is quite impressive, even though there is no mention of Pinna.

Hidalgo y Rodríguez, Joaquín González, *Fauna Malacológica de España, Portugal y las Baleares*, pp. 556-559.

Houlihan, Patrick F., and Steven M. Goodman, *The Birds of Ancient Egypt*, pp. 88-90, 153.

Ibn Fadl Allah al-'Umari, Ahmad ibn Yahya, *Bibliothèque des Géographiques Arabes*, 2: 126; see also Serjeant.

Ibn 'Idhari, al-Marrakushi (= Ibn 'Idari), *Histoire de l'Afrique et de l'Espagne*, p. 495.

al-Idrisi, *Description de l'Afrique et de l'Espagne* (transl. by R.P.A. Dozy and M.J. de Goeje), the strange, and variant, account of a ‘water sheep’ is on p. 21; the city of Chinchilla is treated p. 237.

Imammudin, S.M., *The Economic History of Spain (Under the Umayyads)*, somewhat erratic references to various fabrics and natural productions, not all of them indexed, including ‘*abu qalamun*,’ pp. 142, 194 (claims that “skins” of *abu qalamun* were “extremely soft and flexible and in whiteness and texture they were similar to paper,” surely a reference to some kind of parchment with no relation to Pinna!); see also ‘Santarén,’ pp. 207-208; p. 212; p. 405, al-Mansur's gift is still sealskin here.

Imammudin, S.M., *Some Aspects of the Socio-Economic and Cultural History of Muslim Spain*, p. 95, a slanting reference to Istakhri's account of Pinna, a “sea animal whose wool (fur) was used in making rich dresses”;

this is listed under "Agriculture" – but, under "Minerals and Industries," p. 107, we hear more of *sammur* (Castor – that is, beaver!) and "Abu *Qalmun*": a marine animal found at Santaren, as reported by Istakhri.

Istakhri, see various allusions to his work, especially Abulfeda (1848), Laufer (pp. 111, 112-113), Serjeant, p. 60.

Jacob, Georg, *Studien in arabischen Geographien*, 2: 60-61, references drawn from Istakhri, Maqdisi and Qazwini, under "Pinna und Cypraea."

Kalkashandi (al-Qalqashandi, Ahmed ibn 'Ali); see Serjeant, 1951: 61, for all that I can find in a non-Arabic account.

Karabacek, Josef, *Über einige Benennungen mittelalterlicher Gewebe*, pp. 22-24.

Laufer, Berthold, "The story of the Pinna and the Syrian lamb"; the story of Sea-silk in the Arab world is told particularly on pp. 111-114 (Istakhri, Qazwini, Maqdisi); p. 112, account of iridescent fabrics incorporating bird feathers; his feeling that such fabrics were shabby was part of a conviction, p. 113, that Sea-silk did not need to be so 'vandalized' by giving it qualities that it did not naturally have; actually, it is moot whether fabrics incorporating colorful or iridescent feathers had anything to do with Pinna's Sea-silk.

Leggett, William F., *The Story of Silk*; there is a good deal on Moorish Spain but no reference to Sea-silk.

Lombard, Maurice, *Les textiles dans le Monde Musulman du VII au XII Siècle*; a thoroughly good work, although the bibliography is more background than a list of cited works; al-Mansur's gifts, pp. 99-100; under "Rare Textiles," p. 113, 'laine de mer,' sea-wool, *suf al-bahr* – equated with *butz*, *byssos*, etc.; and p. 114, after processing, Sea-silk was spun and woven into fine, costly textiles; he records it historically from Syria, Egypt, Ifriqiya (Tunis), southern Italy, Sicily and western coasts of the Iberian Peninsula; he alleges that it took dyes readily (although early Christian moralists thought its natural color a chief glory that dyers could not equal) and was used to make dark-green garments for the sultan, many years being required to gather sufficient fiber for the fabrication of a single garment.

Maqdisi; see Serjeant, p. 60, for English version.

Makkari, see Serjeant, p. 60, for English version; his confusion about the fur- or down-producing animal *sammur* is understandable, although what he may have meant by his own statement "It has great power of distinction,"

I cannot imagine; I suppose that he must have meant that it was unlike anything else in the world, although I really doubt that one would use such a superlative in regard to the fur/pelt of a semi-tropical mammal like the monk seal or even the beaver, if one is to accept the term for its hair – whereas, a fur like that of the North Pacific sea-otter would qualify.

al-Maqrizi, Ahmad ibn 'Ali (1364-1442); Mez (1937: 461, no. 5) cited a reference in al-Maqrizi, *Khitat*, 1: 416, to carpets of *Abu qalamun* (or equivalent) in the storehouse of the Fatimid Caliphs (ruled ca. 905-ca. 1150) of Egypt; the reference seems to be to a work in Arabic.

Meyer, Hermann Julius, *Meyers Konversations-Lexikon*; 3: 706, 'Byssus'; he clearly distinguishes between ancient and modern uses of the word.

Mez, Adam, *The Renaissance of Islam*, under "Industry," p. 461; he notes references to Muqaddasi, Maqrizi; he thought *Abu qalamun* at first (11th century) associated only with Tinnis, near Cairo, and not reported earlier even there.

al-Muqadisi, Muhammad Ibn Ahmad (b. ca. 946), *Description de l'Occident Musulman*, transl. by Charles Pellat; in writing of the states of the *Fat'imide* empire, to the borders of Damascus, p. 53, he recounts, as quoted above, the classic Arab story of the beast called *Abu qalamun* that scrapes its silk off on rocks of the shore.

Nasir-I Khusraw (see main bibliography for full name), *Sefer Nameh; Relation du Voyage de Nassiri Khosrau en Syrie, en Palestine, en Egypte ...*; transl. by Charles Schefer; Arab scholars cite the Arab version; for the French, see Schefer's account of 'bouqalemoun,' found only at Tinnis, pp. 111, 113; descriptions of elaborate ceremonial use of Sea-silk, etc., occupy pp. 137, 151-152, 157, 158.

Needler, Winifred, "Three pieces of unpatterned linen from ancient Egypt in the Royal Ontario Museum," in V. Gervers, ed., *Studies in Textile History*, pp. 238-251; see particularly herringbone pleating shown in Fig. 2, p. 240; an effort to reproduce the effect of this pleating in a stylized drawing it seems to me might result in the rippled effect that Dalley conceives to be found in Sea-silk.

Pellat, Charles, "Gahiziana, I / Le *Kitab al-Tabassur bi-l-Tigara*, attribué à Gahiz"; several interesting items are mentioned, including, p. 158, 160, *Abu qalamun*.

Pelliot, Paul, *Notes on Marco Polo*, I: 183, points out that "the western counterpart of the 'water sheep' has not been traced, so far, to a text

earlier than the Arabic accounts of the 10th cent.”

Pérès, Henri, *Esplendor de al-Andalus*, p. 308, 320; more smoke than fire but does show undercurrent of interest in our subject, even in poetry, for one wishing to look for it.

Pfister, R., *Textiles de Palmyre*; see, p. 34 and notes thereto, his skepticism that Sea-silk figured largely in Roman Syria.

al-Qazvini, apparently only Arabic texts exist; see Imammudin, Jacob, Laufer (p. 111) and Pérès for citations.

Reil, Theodor, *Beiträge zur Kenntnis der Gewerben im hellenistischen Ägypten*, pp. 116-122, no reference to Pinna and Sea-silk in “Textilwaren der Papyri.”

Schaefer, Gustav, “The principle of the loom,” negative for any reference to Sea-silk, etc., in ancient Egypt.

Serjeant, R.B., “Materials for a history of Islamic textiles up to the Mongol conquest” – “Sea-wool,” pp. 60-61; definitive translations of Istakhri, Makdisi, Yakut, Makkari, Ibn Fadl Allah al-'Umari, Tidjani.

Silbermann, Henri, *Die Seide*, Pinna and Sea-silk, 1: 71-72, 337-338, a pretty full account with many citations to literature.

Staniland, Kay, “Medieval courtly splendour,” pp. 10-11.

al-Tidjani, Mohammad Abd Allah ibn Ibrahim (fl. 1309), “Voyages ... dans la régence de Tunis,” p. 128.

Viré, F., see *Encyclopaedia of Islam*, Supplement.

Yakut Ibn 'Abd Allah, al-Hamawi (?1179-1229); evidently all useful versions are in Arabic only; cited in Lombard, p. 114, note 2; Pérès, p. 320, note 123; see Serjeant, p. 60 for translation.

Alarums And Excursions: Maids In Scanties, Waterweeds And A Marine Fish

With the present topic, we go back into the realm of total hearsay and folklore. The excursion will, at least, have the utility of clearing up a couple of vague attributions in the overall legend of Pinna and of explaining why I started studying the subject in the first place.

First things first: in 1990, I had a letter from my friend Charles Boewe, eminent authority on the early naturalist Constantine Samuel Rafinesque. He told me of a painting in the Borghese Gallery in Rome by Jacopo del Zucchi, entitled ‘Treasures of the Sea.’ What Dr Boewe accounted a principal treasure, byssine (a dictionary name for Pinna’s Sea-silk), was not mentioned in descriptions of the picture. Yet, he suspected that several of the nude females in the picture were engaged in gathering and, by means of drop spindles, spinning byssine into yarn for making delicate textiles.

I had never heard of Pinna or of Sea-silk. Neither my wife nor her hand-weaving friends knew of a fabric made from any such material as Sea-silk.

It was some time before I had a good color reproduction of the Zucchi painting in hand and realized that there were no Pinna shells anywhere in it. Further, the fishers, nude or not, were not using drop spindles. They were carrying rock-weighted sinkers by which they sunk nets that were dragged over the bottom of the Mediterranean to fish up branches of precious coral that become entangled in the nets.

I was, however, already on my way with Pinna!

My friend was interested, he explained, because in a letter, written in 1810 from Sicily, Rafinesque had announced the discovery of a new marine plant that he named *Lamaxis glomerata*. His correspondent evidently put him right, for in his next letter, Rafinesque admitted that his ‘plant’ was the “spray of a Shell.” Clearly, Rafinesque did not know anything about Pinna at that time and did not even use the contemporary common term ‘beard’ for what sophisticated zoologists by then would have called a byssus.

Rafinesque can be forgiven, for a beard of Pinna, picked up on the beach, would look much like a tuft of dried filamentous red seaweed. More to the point: down through the centuries there have been puzzling allusions to fibers of plant origin from the sea. There were sometimes claims that the fabled Sea-silk might have such an origin.

Aside from references to 'Lana marina,' to be treated shortly, Abd Allah Ibn Ahmad (called al-Baitar) (died 1248) had heard that in olden times certain people maintained there was a "species of 'lentil'" (presumably an algal seaweed, not the tiny freshwater flowering plant *Lemna*, or Duckweed, sometimes given the same or a similar name) that grows on rocks of the bottom of the sea. However, he dismissed the notion that it could be the source of Sea-silk; that came, he correctly maintained, from a shellfish.

Under the term *Thohlob*, al-Baitar appeared possibly confused. His translator claimed that plant to be 'Lentille d'eau,' but it seemed to be, at least in part, a kind of 'Lana marina,' some sort of filamentous alga that might be woolly when dried, which *Lemna*, also called 'Lentille d'eau,' would not be.

Considering that al-Baitar was greatly interested in medicinal substances, it is pertinent to consult Robert T. Gunther's *Greek Herbal of Dioscorides*, a respected contemporary reference on botanical medicine. His "Bruon Thalassion," is described as a hairy, moss-like aquatic plant. It is mistakenly identified by Gunther as the Green alga *Ulva*, Sea Lettuce. Sea Lettuce is a plant quite unlike either the illustration of a rooted land-plant that has come to be associated with Dioscorides's name or his description of it. This plant (No. 99) is followed by "Phukos Thalassion," identified as either *Posidonia* (a marine flowering plant) or *Laminaria* (one of the kelps, a large Brown alga); its description in this version of Dioscorides seems garbled.

It is interesting that in a German edition of Dioscorides of 1610, 'Meermoss / Bryon thalassion / Muscus marinus' is illustrated by a quite naturalistic-looking branched filamentous alga – certainly not Sea Lettuce, with its broadly flattened leaflike body. 'It grows on stones and shells of sea-fish beneath the sea and is a narrow herb like hair without a stalk.' And 'Meergrass / Phycon thalassion / Fucus marinus' is illustrated as a long (tall) bifurcating sea plant but is said to be of various kinds, some broad, another long and brown-red; if the picture is to be trusted (pictures of the succeeding references to *Potamogeton* and *Millefolium* look convincing), it is likely an alga, not a marine flowering plant such as *Posidonia* or *Zostera*.

Henri Pérès, referring to allusions in the poetry of Moorish Spain, had Marine Silk (*suf bahri*), generally held to be *Abu qalamun*, as possibly "an alga of great rarity." Note that Makkari, as quoted in Serjeant, was unsure whether 'the down of the sable' might not be of marine plant origin.

Whether the confusion was the viewer's or his host's, John Evelyn visited the collections in the Museum of "Ferdinando Imperati" (Fer-rante Imperato) in Naples in 1645 and saw there, among "the Natural Herbals," "the Byssus Marina, & Pinna Marina." The present-day editor dismisses 'herbals' (intimating something of plant origin) as a 'curious instance of Evelyn's carelessness,' but it is possible that he saw what was claimed to be both plant and animal substances. It is notable, I think, that there were in an Italian museum at that time no examples of a textile attributed to this 'byssus.'

In Diderot's *Encyclopédie*, *Byssus* was nothing but the proper scientific name of a water plant (the plant fiber used in making textiles came under the word 'Bysse'), just as in a botany book of the time, such as Henry Muhlenberg's list of American plants. In the near-contemporary *Encyclopaedia Britannica*, "Byssus" alone was used but it simply had more than one meaning. A century later, Hermann Julius Meyer referred to a previous use of 'Byssus' for some species of what he called *Fungi Imperfecti*, evidently of an algal nature.

Modern botanical use of a scientific name need not concern us further but it is notable that careful study takes us back to real uncertainty whether "Lana marina" was animal or plant. Simply insisting that all such terms refer to Sea-silk will not do. Rolf Heine tends to argue that *Lana marina* is of animal origin, references to plant material perhaps being, he thinks, a late attribution. Just how *Lana Marina* was used is not clear – perhaps it was a wad of material used to keep soothing ointments or oils (as in earache or when an ulcer was being treated) in place. Whether this accounts for the notion of Filippo Buonanni that Pinna's Sea-silk was helpful in treating deafness, I cannot say. Suffice it to say that Henri Beauregard's comprehensive *Matière Médicale Zoologique* does not list Pinna as a source of drugs, etc., of any sort. (Antoine Joseph Dezalliere d'Argenville held that "the Pinne Marine promotes urine," no doubt hailing back to Greek

notions that it was a diuretic when ingested.)

Jacques André lists all sorts of Classical Latin uses of words implying the existence of plant wools, especially aquatic sorts.

This, however, gets me ahead of my story. I quickly convinced myself that folklore had doubled back upon itself and that there was no substance to "Lana Marina" that did not go back finally to Pinna's Sea-silk. I was then shaken to read in Maurice Lombard's learned account of Arab textiles of the 7th to 12th centuries what seemed at first a most curious reference to Sea-silk. Certain descriptions of it, he wrote, 'remind one of the balls [wads] of fibers of *Posidonia*, rolled by the waves and presenting the appearance of balls of hair.' *Posidonia* balls, he noted, lacked the silken aspect of Sea-silk but there were similarities. Could this somehow account for some of the confusion of the past? One might imagine, for example, that people mistakenly supposed that the 'wool' of the water sheep was to be gathered as balls of fluff along the shore, similar in size, texture and color to the balls of Lombard's *Posidonia*.

My first thought was that *Posidonia* must be a kind of sea-shell: that is, another Pinna-like maker of a tuft of precious, fine down. But *Posidonia*, as an animal, my authorities assured me, could be nothing but a long-extinct mollusk of geological antiquity.

If *Posidonia* was not animal, was it possibly plant? Lombard's description of 'Posidonia balls' reminded me of 'Lake Balls,' formed by colonies of the branching, unattached filamentous Green alga, *Cladophora*. Aided, perhaps, by the action of waves, these form perfectly globular bodies of great solidity that are often several inches in diameter. (These are one part of a grand class of substances, usually ball-shaped and substantial, both plant and animal in origin, known as *bezoars*, once highly regarded as sources of marvellous cures, as may be inferred from the studies of Geoffroy.)

Yes, *Posidonia* was indeed the name of a marine plant. The genus consists of three species and is common on the Mediterranean and Australian coasts. It is a monocot flowering plant, either considered as making its own monogeneric family Posidoniaceae or, with various

other aquatic genera, making up the family Potamogetonaceae (or Najadaceae or Zosteraceae). J.C.Th. Uphof describes it as "Source of Posidonia Fibre, Cellonia, Lanamar; used for sacks, coarse fabrics; also mixed with wool. Recommended for packing material and for stuffing." J.C. Willis and H.K. Airy Shaw note: "Stems used for packing glass." They indicate the related marine flowering plant, *Zostera*, to be "largely used for packing glass, stuffing cushions, etc., esp. in Venice."

Then, I read accounts of modern ecological studies of Pinna and the efforts being made to reestablish its sadly depleted numbers in the Mediterranean (Combelles et al.; Gaulejac and Vicente). The most favorable habitats for resettling the young animals is in protected areas within undisturbed meadows of *Posidonia*!

What tales can be told of all this a thousand or two thousand years from now!

There is one final story, quite off the wall as far as I can tell but told with a seemingly straight face by Henri Silbermann in his thoroughly documented history of silk. In a list of animals that offer promise in silk production he had *Pinna nobilis* and *P. rudis*, *Tridacna gigas* and, oddly, *Raja batis*. Now, *Pinna* and *Tridacna* have a byssus organ although the fibers of the latter are entirely unsuited for spinning. But *Raja batis*! This is the skate or ray, familiar to a viewer of wonders of sea-life in any marine aquarium and not a true fish but a member of the cartilaginous animals to which sharks belong. Can anyone explain to me why Silbermann wrote (it is my own translation but I think I have it right): "There was exhibited by Joly in Paris in 1867 Sea-silk [Seeseide], "soie marine," obtained from *R. batis* on the coast of the Vendée [the Atlantic coast of France]"? True enough, the skate's young hatch from a bag-shaped egg-case with its peculiar wall of a pliable substance – is it possible to fray it and spin it? I have never heard of such a thing – but I await enlightenment.

References

Abd Allah Ibn Ahmad (al-Baitar), *Traité des Simples*, 2: 385 (#1422), a wool, *Souf*, that was used medicinally; 2: 386 (#1423), a reference to the mistaken notion that *Souf el-bahr* might be a plant; 2: 403 (#1451),

Thohlob, Lentille d'eau; 2: 438 (1518), A'des, Lentille, used medicinally; see also 2: 439 (1521).

André, Jacques, *Lexique des Termes de Botanique en Latin*, p. 178, *Lana*, *Lana de aquatica*, *Lana marina* – I suspect that some higher plants such as *Posidonia* cannot be ruled out; p. 183, *Lens*, *Lenticula*, etc.

Beauregard, Henri, *Matière Médicale Zoologique*, negative but, p. 162, an interesting reference to 'Aegagropiles,' which I take to be bezoars, among which he lists *pelotes de mer* (Sea Balls) made of filaments of *Zostera*.

Boewe, Charles, letters 3 De and 18 De 1990.

Buonanni, Filippo, *Ricreatione dell'Occhio e della Mente*, p. 156; the passage is ambiguous; Chemnitz quotes it, disapprovingly, in Latin, "Byssus pinnae in auribus positus surdos juuat"; in Italian, as I have seen it, the word is "sordaggine," which is definitely 'deafness' – thus, it is hard to suppose that Buonanni himself thought of Sea-silk or the fabric made from it as simply a wad of material that might soothe a case of earache (he has it that the fabric served admirably to protect the human body from the humidity of winter – thus, hardly a reference to a diaphanous material).

Chemnitz, J.H., in Martini and Chemnitz, 8: 210, citation of Buonanni.

Combelle, S., et al., "Contribution à la connaissance de l'écologie de *Pinna nobilis*"

Diderot, Denis, *Encyclopédie*, etc., 2: 471.

Dioscorides, Pedanios (fl. ca. 50 AD), *The Greek Herbal of Dioscorides*, by Robert T. Gunther, p. 495 (#99, 100).

Dioscorides, ed. of 1610, pp. 300-301, *Meermoss*, *Meergrass*, etc.

Encyclopaedia Britannica, 1st ed., 1: 697.

Evelyn, John, *Diary*, 2: 330-331 and footnotes.

Gaulejac, Beatrice de, and Nardo Vicente, "Écologie de *Pinna nobilis*" specimens of less than 20 mm shell height can be transplanted successfully into *Posidonia* meadows, its preferred habitat, where they are free from disturbance from wave action.

Geoffroy, Claude Joseph, "Observations sur le bezoard, & sur les autres matieres qui en approchent."

Geoffroy, C.J., "Suite des observations sur les bezoards."

Heine, Rolf, "Lana marina," doubts, p. 48, that this was ever used as a medicine directly; rather, thinks references were originally to soft absorbent bandages; argues at length for the animal nature of it and thinks that references to "Lana marina" as of plant origin are a late manifestation.

Lauffer, Siegfried, *Diokletians Preisedikt*, p. 264 (#14).

Lombard, Maurice, *Les Textiles dans le Monde Musulman*, pp. 113-144.

Makkari; see Serjeant, p. 60.

Meyer, Hermann Julius, *Meyers Konversations-Lexikon*, 3: 706.

Muhlenberg, Henry, *Index Florae Lancastriensis*, 4: 239.

Pères, Henri, *Esplendor de al-Andalus*, p. 308.

Silbermann, Henri, *Die Seide*, p. 338.

Uphof, J.C.Th., *Dictionary of Economic Plants*, n. 426.

Willis, J.C., and H.K. Airy Shaw, *A Dictionary of the Flowering Plants and Ferns*, p. 939.

Zucchi (or del Zucca), Iacopo (Jacopo) e Francesco (1541/2-1589/90): I combed the usual sources for biographical information and these need not be cited here; I owe particularly to Dr Edmund P. Pillsbury, Director of the Kimball Art Museum, Fort Worth, great thanks for furnishing a reproduction in color (Walpole Gallery, London, *The Cinquecento*, 1991, p. 58, pl. 24) of "Coral Fishing" (53 × 43 cm / 20-3/4 by 17 in) – elsewhere called "Treasures of the Sea"; my colleague Corrado Baglioni described for me the use of weighted nets to 'fish' for precious coral.

And 'Cloth Of Gold'?

This chapter focuses on a common fault in the scholarship on *Pinna* and *Sea-silk*. It is an example of what Mary Lefkowitz has written "might be called syncretism, but is really a kind of pseudo-mystical mixing and matching of symbols and ideas that have nothing in common with each other except the contemporary use to which they may be put."

St Basil the Great, stunned by the power of God to outdo anything within human reach, put it, as the traveler Stolberg translated: "Whence had the pinna its gold coloured wool? that colour which is inimitable!" Since the color needed no improvement, its fame spread. Its rarity enhanced its value but that, too, hardly proves that it was commonly called Cloth of Gold.

Giovanni Battista Gagliardo, writing early in the last century, might lead you to believe that St Basil had actually called it 'Wool of Gold' ("Lana d'oro" is Gagliardo's expression). This equally misleading rendition goes back to a translation of St Basil in Cataldanton Atensio Carducci's version of Tommaso Niccoló d'Aquino's *Delle Delizie Tarantine*, the source, I think, of several misconceptions about Sea-silk.

Julia Ellen Rogers, author of a popular book on shells, referred to fabric made of Sea-silk as "Cloth of Gold." Where she got the term is not clear – perhaps the same place that Gagliardo got his: perhaps she over-wrote to achieve a highly colored narrative. Various people, perhaps finding her book readily available on library shelves, have picked up her usage.

A stranger case is to be found in a modern college invertebrate zoology text by Mary S. Gardiner. There, amidst a sophisticated text with an abundance of astutely selected and highly finished illustrations, you find, along with allegations that Sea-silk could be woven into diaphanous textiles: "It was because of the trappings of this material that the sumptuous picnic at which Henry VIII of England and Francis I of France met in 1520 became known as the Field of the Cloth of Gold."

Apart from the quibble that the place is properly called 'the Field of Cloth of Gold,' this is pure eye-wash. A.F. Pollard helped to make this clear when he pointed out that the meeting place was "already known as the Val Doré (Golden Valley). He went on: "The obscure but familiar phrase, Field of the Cloth of Gold, is a mistranslation of the French Camp du Drap d'Or." There is not the slightest hint anywhere that those hangings and drapery were made of anything of a golden nature that was not real, metallic gold. Yet, the same no-

tion was repeated by Stella M. Turk (no authority was cited, leading one to think that she probably read it in a readily available reference). Olga Osing writes much the same. Rather surprisingly, a recent Dutch reference on animals, the *Spectrum Dierencyclopedie*, even embroiders on the simpler statements already encountered: The meeting between Henry and Francis "was given this name because the gathered noblemen were dressed in tunics fabricated from the tuft of filaments of bivalve mollusks. It was in no way related to the use of golden thread." Syncretism, or whatever it may be called, was quite out of control.

It may then come as no surprise that a well-read (however ill-informed) person today speaks of a fabric made of Sea-silk as if Cloth of Gold was its settled name. Thus, Karen Ann Saunderson recently wrote an enquiry to the editor of *Handwoven* under that name. In asking for readers' help, she alleged that textiles had been produced using byssus threads, which she had found referred to as Cloth of Gold. Museums had objects made of that strong material. She repeated the claim regarding the meeting of Henry VIII and the King of France, the place's name being bestowed "because many of the nobles assembled there wore tunics made from the beards of bivalves. It had nothing to do with gold thread."

At the other extreme, which I certainly assume to be the truth of the matter, Pamela Clabburn defines "Cloth of Gold" in her *Dictionary*: "Fabric, generally of silk, with some gold threads woven in. Of very ancient origin ... The meeting place of Henry VIII ... and Francis I ... was named the Field of the Cloth of Gold because of the amount of fabric woven with gold thread that was used."

I shall not here quote further authorities who know no cloth of gold but that which incorporates metallic gold. For those wishing to pursue the history of real Cloth of Gold, the following References include an annotated list of pertinent authorities on this subject.

It may be pointed out that the Greeks and Romans were passionately fond of yellow fabrics. The dyes used were often very expensive, their dearness no doubt sometimes rivaling the cost of metallic gold. Thus, A.J. Cofrancesco reports that the Romans used the pure yellow

pigment of the flavone dye luteolin (obtained from the weld plant, *Reseda luteola*), to dye the garments of the Vestal Virgins. It is the oldest known European dye. The Greeks and Romans likewise used the yellow dye Curcumin (turmeric), obtained from the roots of the plant *Curcuma tinctoria*. Crocetin, occurring as saffron in pistils of the crocus, *Crocus sativus*, has been used as both dye and spice. "In the early days of Greece, yellow was the official color, and Grecian women were especially fond of clothes dyed with saffron. Because of its scarcity, saffron ranked among the most expensive dyes of the ancient world." It created a 'cloth of gold' in cost if not constitution! The Arabs likewise knew of its yellow color and gave their name za *farān* (yellow) to saffron.

References

Anon., *Spectrum / Dierencyclopedie*, vol. 4: 1401 (I thank Kaes Weyts for translating this).

Aquino, Tommaso Niccoló d', *Delle Delizie Tarantine*, p. 261.

al-Azdi, Muhammad ibn Ahmad, *Hikayat*, a work apparently going back to the first half of the 5th century; reference is to a 'fine cloth' called *Kasab*; the German editor, Adam Mez, writes, p. xlv: gold and silver were originally applied to the surface of cloth by means of gold-coated reeds, etc., but today 'all *Kasab* is made only with silver or gold spun silk' (that is, silk covered by a thin filament of metal in the complex process called by him 'umspinning').

Basil, Saint; see Stolberg, as well as Basil's *Exegetic Homilies*, p. 115, and *Opera Omnia*, 1, col. 653.

Bock, Franz, *Goldstickereien und Webereien in alter und neuer Zeit*, a great authority on the subject of cloth of gold (the metallic sort only), brought to my attention by Norman Indictor.

Clabburn, Pamela, *The Needleworker's Dictionary*, p. 62.

Cofrancesco, A.J., "Dyes, natural," pp. 792, 801, 803.

Faber, G.A., "Dress and dress materials in Greece and Rome", p. 297.

Gagliardo, Giovanni Battista, *Descrizione Topografica di Taranto*, p. 77.

Gardiner, Mary S., *The Biology of Invertebrates*, pp. 94-95.

Geijer, Agnes, *A History of Textile Art*, throughout are references to the use of metallic gold in producing textiles: never any other material such as Sea-silk.

Lefkowitz, Mary, "The twilight of the Goddess."

Lutz, Henry F., *Textiles and Costumes among the Peoples of the Ancient Near East*, gold cloth, pp. 97-99.

MacGregor, Arthur, ed., *The Late King's Goods*. "One lewer [lure used in falconry] of cloth of gould," belonging to the unfortunate Charles I, p. 407; no doubt a fancy souvenir rather than a useful piece of equipment – and one certainly incorporating metallic gold.

Osing, Olga, "Silk from the sea."

Pollard, Albert Frederick, *Henry VIII*, pp. 103, 300 (caption to plate illustrating "Meeting of Henry VIII. and Francis I. at the Field of Cloth of Gold, in 1520, from the painting in the Royal Collection at Hampton Court Palace").

Rogers, Julia Ellen, *The Shell Book*, pp. 402-403.

Staniland, Kay, "Medieval courtly splendour," a delightful account of costly trappings of 14th century England, with reference to cloth incorporating metallic gold throughout (but see especially pp. 15, 17); there is a detailed accounting of the gold leaf used; there are fabulous inventories of the number of days' work, the number of people employed and the wages received, pp. 12-14).

Saunderson, Karen Ann, " 'Cloth of Gold,' " a request for information.

Stolberg, Frederic Leopold, Count, *Travels*, his reference to St Basil, 2: 151.

Turk, Stella M., "The silk worm of the sea, spinner of cloth of gold," p. 42.

Watson, John Forbes, *The Textile Manufactures and the Costumes of the People of India*, pp. 109-110, with reference to metallic gold only.

Wild, John Peter, *Textile Manufacture in the Northern Roman Provinces*, gold cloth, pp. 39-ff.

Wilson, Kax, *A History of Textiles*, general history of cloth of gold, p. 30.

Yates, James, *Textrinum Antiquorum*, see pp. 366-ff for thorough account of cloth using metallic gold.

What Do You Mean, “ ’Twas Byssus?” – And The Slithy Toves ...

Two chapters must now be devoted to tangles that are technically insoluble so long as people use words without recourse to factual analysis. We have reached a point where honest people are misled by what they perceive as the substantiality of terms.

The questions are, firstly, involuted around and within the word ‘byssus’ (in its variant forms) and, secondly, the question whether what is meant by a ‘fine cloth’ (in the sense of a diaphanous fabric of expert workmanship through which you can see) ever regularly referred to articles made of Sea-silk.

The matter of byssus requires attention, because the word as presently used has preempted older, legitimate usage. Consider the practical effect, as shown by Gabriel Vial’s account of a silken fabric woven in 8th century Lyon, said to be ‘byssus,’ and, however unaccountably, thus now taken to be made of Sea-silk rather than what would have originally been meant by the term. It proves to be neither classic byssus nor Sea-silk but silkworm silk. Other examples of this sort will be noticed in my account.

Philosophers of meanings can be either small-minded or big-minded. The former posture makes for easy reading and fits comfortably into the demands of mediocrity for a short, simple answer to every query. So it is today. Most people go to their dictionary and come out with the absolute truth: byssus is the fibrous, sometimes silken secretion of an organ of certain bivalve mollusks. *Period.* Some authors are not even beyond creating a phony etymology to firm up that simplification.

In my account of Pinna’s “Greek Connection,” I introduced the word byssus. A proper history of the word that comes to us largely from the Greek ‘Byssos’ or similar term is out of my power to accomplish. Anyway, the word is not of Greek origin and one’s net must be cast more widely for a firm answer. What concerns me here is that, for some thousands of years, the word did have at least in part the general meaning of a fine quality (not, however, necessarily sheer or diaphanous) cloth made of material of plant origin. Some had

it made of linen, some of cotton, some of either at different times and in various places. Julian Pollux (ca. 130-188 AD) produced a thorough etymology of the word *byssos* (etc.), as used in Greece, with no indication that Sea-silk was ever included.

At the risk of some repetition, I shall try to show how all that changed (maybe the popular press made possible by the spread of mechanically printed books had something to do with it) with Guillaume Rondelet’s acceptance of what was pretty surely a scribe’s misreading of Aristotle. Instead of having Pinna ‘rooted’ to the *bottom*, the translator had it that Pinna grew up from the ‘rooting’ structure that got called by a name formerly meaning ‘depth’ or ‘bottom.’ In spite of a great deal of scholarly argument against this interpretation, as P.J. van der Feen has written, the word has stuck. Thus, people pretty generally say that Pinna has a byssal organ; this organ, called its byssus, secretes a substance that forms the byssal tassel; this silken beard may be spun and woven into byssine. And so on. (Where a modern shell-collector named Walter Freeman Webb got his decidedly home-grown word ‘Brissus’ for ‘byssus,’ I have no idea; somehow, I wish he had had a good reason for it!)

All right. I can live with that, so long as what I must continue politely to call syncretists do not insist that the new meaning of byssus can be plastered over every use of the word throughout history.

If we stick essentially to what major authors have written, one may keep the subject within the confines of a single chapter. Along the way, certain uses in various trades will be cited, to demonstrate how the common understanding sways with the winds of authority.

Herodotus (5th cent. BC) took both *Buthos* and *Bussos* to mean depth of the sea or a river or the bottom of a well (as in our words ‘bathysphere’ and ‘abyssal’). He also used the word *Bussinios* to mean flaxen or in reference to fine linen used in mummy preparation but often used a different word for ‘linen.’

Pausanias (fl. 176 AD) consistently used words similar to byssus for flax and linen, especially with reference to fine linen. It is evident that if Pausanias had known of a fine cloth being manufactured from

Sea-silk, he would have reported it. His interest in fiber sources was quite detailed. "There are," he wrote in his *Description of Greece*, "two marvels in the land of Elis: one is that fine flax grows here and nowhere else in Greece; the other is that the mares cannot be impregnated by asses within the borders of Elis, though they can be impregnated outside them. ... The fine flax of Elis is not inferior in fineness of texture to the fine flax of the Hebrews, but it is not so yellow." Again: "The land of Elis is fruitful, being especially suited to the growth of fine flax [*bussos*, that is *byssus*]. Now while hemp and flax, both the ordinary and the fine variety, are sown by those whose soil is suited to grow it, the threads from which the Seres make the dresses are produced from no bark, but in a different way as follows. There is in the land of the Seres an insect which the Greeks call *ser*, though the Seres themselves give it another name." There follows his fantastic account of one or another of the wild silkworms (that is, not the domesticated Chinese silkworm). Sir James G. Frazer's annotations on *bussos* are valuable in that whatever the word meant (he thought it linen), it had nothing to do with Pinna's Sea-silk.

It appears clear, however, that Philostratus Flavius (b. 172 AD) definitely described *byssus* as cotton. In his *Life of Apollonius*, we learn that the upper classes in India "are apparelled in *byssus*; and that the *byssus* grows upon a tree of which the stem resembles that of the white poplar, and the leaves those of the willow. ... And the *byssus* is imported into Egypt from India for many sacred purposes."

These various conclusions agree with Paul Pelliot's statement, in his masterful account of cotton. Deploring latter day definitions of *byssus* as only cloth made from the excrescences of sea-shells, Pelliot noted: "In classical Greek, *Bussos/Byssus* was the name of a costly textile, generally white, sometimes yellow (the only one produced in Greece proper, in the vicinity of Elis in Achaia, was yellow); opinions are still at variance whether it was 'cotton' or 'flax,' the balance of opinion being at present in favour of the latter ...; in any case, it was a vegetable stuff, which had nothing to do with sea-shells. On the other hand, our zoological nomenclature gives the name of 'byssi' (plural of 'byssus') to the filaments secreted by the foot of the *Pinna*

and other bivalve molluscs." That states the matter clearly.

Let us see how history has dealt with it.

Guillaume Rondelet, in 1554, put zoological nomenclature firmly in place. However, knowing some of the contrary facts, he set it down that there were *two* kinds of *byssus*: that on land and that in the sea. The latter sort was Pinna's beard. Thoughtful classicist that he was, Filippo Buonanni in 1681, too, was careful to distinguish between Pinna's beard (called Lana' [wool] by some), Bisso marino,' and the land sort of *byssus* (by some said to be made of linen, by some, cotton, he says). By this date, too, Sea-silk was being woven into admirable fabrics that were capable of protecting the human body from the damp of winter. Buonanni makes nothing of an extensive industry in that weaving, however.

By 1700, natural history was beginning to clean up its nomenclature and eliminate purely mythical elements from descriptions of the real world. The new zoological nomenclature crept in preemptively. Naturalists were generally content to remember only Rondelet's *byssus* of the sea.

Guido Panciroli, in a work published in English in 1715, had a long list of "memorable things lost, which were in use among the ancients," including Purple, "Asbestine, or Unquenchable-Flax," and a "Silken Flax call'd *Byssus*." There was some uncertainty about *byssus*: while some took it to be extraordinarily fine flax, "some think it to be that delicate Down and woolly Substance, which sticks to a certain kind of Shell-fish call'd *Pina*, is of a dirty Colour whence are made a sort of Garments call'd *Byssine*, of that most curious delicate Wooll, which is of a clayish Colour inclining to black, but as bright as Gold." Still, the overall emphasis was on a plant origin for *byssus*.

The great Antoine de Réaumur studied the anatomy of the bivalve *byssus*, for the first time making it possible for naturalists to shed notions that it was a mere excrescence, a feeding organ or solely a place of refuge for the Pinna-guard. He turned his attention to Pinna, denominating it "the silkworm of the sea."

French naturalists continued to be busy, setting the stage for the singularly broad-ranging Encyclopaedists and their generally skeptical approach to many popular myths of old. Claude Joseph Geoffroy ("Geoffroy Le Jeune") forged ahead with thoughts on Pinna, his thinking clear-headed for the most part, despite his conviction that there was medical virtue in all that vast raft of substances that he fancifully made to fall under under the catch-all term "Bézoards," or, as we should spell it today, bezoars. Among bezoars, possibly having curative powers, he included Pinna's pearls and, perhaps as a kind of related excrescence of a shell-fish, the byssal beard. He had little use for the old tale of the Pinna-guard, a revisionary stance that became a watchword among writers of dictionaries and encyclopaedias of the Enlightenment, with many of them putting Geoffroy's precise words under their own name without a credit line. Both he and they mistakenly stated that "the ancients," beginning with Aristotle, actually called Pinna's silken beard "byssus," 'either from resemblance to the byssus that was spun of precious materials or because it was the same byssus that they spun into those fabrics.' He went on to say, evidently as confused as his statements indicated, that the ancients were able to distinguish only two sorts of byssus, that of Greece and that of Judea. 'It was not easy,' he admitted, 'to determine if byssus was drawn from the shells of which I speak.' He did know that Pinna's beard could be spun into a fabric that was highly valued 'in the centuries when silk was very little known and was rarely seen.' For, he noted astutely, 'this byssus [of Pinna] spins coarsely but is very much more beautiful than wool and approaches silk in beauty.'

The German lexicographer Johann Heinrich Zedler would have little to do with 'Byssus' in any but the classical sense of fine linen: and of a quality that was no longer achieved.

M. l'Abbé Favart d'Herbigny did not stray far from Réaumur and Geoffroy.

Denis Diderot's great brain-child, the *Encyclopédie*, tackled, in the arch manner of the time, under the word *Bysse*, the matter of byssus. 'It is singular that this word is the same in Hebrew, Greek, Latin and French, without one knowing exactly what it means. One learns only that it is the name of the material that served as a fabric for mak-

ing very rich garments.' There are references to sacred and profane writers. 'Most naturalists,' it is noted, 'maintain that this byssus is the silk of Pinnae Marines, or of the pearl oyster, put into use.' David, it is related, wore a mantle of byssus, as did all the cantors and Levites. With characteristic clear-headedness, the writer dismissed the 'amusing' notion that byssus was Sea-silk: 'It is difficult to persuade oneself that in the time of David and Solomon, the silk of the fish Pinna can have been common enough in that country, for so great numbers of powerful people to have been provided with mantles.'

The Encyclopaedist finally miscredits Aristotle, pilfers most of the conclusions of Geoffroy the Younger and then proceeds to leave the matter in a muddle.

The writer of the initial edition of the *Encyclopaedia Britannica* (1771) had few thoughts on the subject of Byssus and described it, as did the French, as either an Alga of some sort (having nothing to do with fabrics) or, on the other hand, in a very short piece, a fine Egyptian linen.

Emmanuel Mendes da Costa (1776) entertained no doubts: "The Byssus of the antients, which I am convinced was made of the beards of the Pinnae Marinae, or Sea Wings, and such like bivalves."

Dobson's American version of the *Encyclopaedia Britannica* (1790), no doubt as a result of its authors having found other encyclopaedists full of information on the point, expanded coverage. *Byssus* was a "fine thready matter, produced in India, Egypt, and about Elis in Achaia, of which the richest apparel was anciently made," probably a kind of finer linen, "frequently dyed of a purple colour." Beyond that, there appeared to be confusion among the experts, some of whom thought it might be made from "the lock or brush of silky hair found adhering to the pinna marina, by which it fastens itself to the neighbouring bodies." There are several useful references in its account of *Pinna* but, with them, a return to the Dark Ages as far as *Pinna* and the *Pinna-guard* are concerned: in the latter regard the author credited Hasselquist with confirming Aristotle's ancient myth.

Abraham Rees's *Cyclopaedia* (1805) came to no decision in regard to byssus; the reference to Pinna is a bit muddled.

Edward Baines (1835), in a considerable history of cotton, attempted to keep the term byssus, as a fabric, for material that was always of plant origin. He was content that it was linen only, citing microscopic evidence.

Franz Passow, German lexicographer, listed all Greek words even remotely related, let everyone have his way and generally left decisions up in the air. The Greek term *Byssos* was cotton of Egypt and India, white or golden in color; also a costly fiber used on Elis, of the silken beard of Pinna made [!]. 'Bussos, *Buthus*, for all their shades of meaning, had to do with the depths of the sea. *Pinnikon* (etc.) was a 'kind of dingy-white [!] silk of the Steckmussel (Pinna), collected, spun and woven into clothing, as is still done.' Among authorities cited are the questionable references in the *Periplus*. *Pinninothrix* and *Pinnotrikos* meant 'with hair similar to that of Pinna.'

In Jean Bezon's dictionary of fibers at mid-century, byssus meant all things to all people and could be animal, vegetable or mineral. 'Many naturalists maintain that it is the silk of Pinna, or of the pearl oyster, worked into a production.' He realized that several authors thought it linen, very fine and dyed purple, while others thought otherwise. In regard to natural history, he echoed French opinion of the previous century.

John Yeats, in his account of the natural history of the raw materials of commerce, had a very general account of byssus as the beard of Pinna only, ignoring all confusing references to nonmollusk fibers.

S. William Beck put it thus: Byssus: "The beard of the Pinna, or wing shell." The use of its fibers to make fabrics was "known to Pliny and Aristotle" (in that order!). In contrast, he says, the ancients and more modern commentators are all confused! He records that "Three mantles of byssine lined with fur were ordered by King John for his queen in 1201," but did not further explain 'byssine' and I doubt the relevance of this to Sea-silk.

For Franz Bock, authority on cloth of gold, byssus was always linen. In the nearly contemporary work by Pauly and Wissowa on the classical world, there was some ambiguity, partly because contributor Franz Olck held *Byssos* to mean, at least originally, cotton only (but did think that early people thought of cotton as a kind of flax!). Various fibers were considered in turn and Olck seems finally to have thought that to the ancients, at least by the second and third centuries AD, *Byssos* meant merely fine cloth, and then, as 'fine cloth,' it came to mean Pinna's Sea-silk. (The last part of the argument is weakened by the absence of claims by Tertullian and other early writers that Pinna's Sea-silk was byssus: to them, it was a thing in itself.)

In the dictionary of antiquity of Daremberg and Saglio, *Byssus* tends to appear as a fabric of great fineness and transparency; some identifiably different fibers, such as *Amorgina*, itself perhaps a kind of flax, was claimed to rival 'byssus' in these respects – it was dearly priced and much sought after and was dyed in red by a plant found on the island of Amorgos, in the Cyclades. Edmond Saglio, author of articles on both *Amorgina* and *Byssus*, calmly supposed that it was probable that ancient authors applied the term 'byssus' to various stuffs. He was certain that Sea-silk had nothing to do with the *Byssus* written of by them.

However, with the general uncertainty of scholars on the one hand and the iron-clad (if more narrowly based) certainty of naturalists on the other, it is perhaps no surprise that historians who ought to have known better fell into the trap of referring baldly to articles made of Pinna's Sea-silk as 'byssus.' Thus, in the translation by Friedrich Hirth and W.W. Rockhill of Chau Ju-kua's geography (13th century), they wrote that a certain Chinese term was to be translated as 'byssus,' although definitely of the opinion that Sea-silk was meant. (Actually, Paul Pelliot pointed out, they ought to have used his term 'mermaid silk' for the material; both he and they agreed, in any case, that it was Sea-silk; Pelliot's displeasure was not so much that they had not used his term but they had used the unfortunate word 'byssus' for it.)

Louis Harmuth's *Dictionary of Textiles* had *Byssine* (his only word of this sort) as: (1) a fine cloth found in Medieval England; (2) the "Old Greek name for fine sheer linen fabric ... woven in Egypt"; (3) the "long and silky hair-like beard of some sea mussels: used for gloves and stockings in southern Italy."

H.G. Liddell and R. Scott went whole-hog for their own version of historical obfuscation by identifying "Tarantine" as garments "made of a diaphanous material woven from the byssus of the pinna." Their run-down on 'bussos,' 'buthos' and all similar words, whence our byssus, is extraordinarily full.

In a catalog of an exhibition of ancient weaving (Anon. 1944), a piece of fabric is denominated as made of "Bissos." No further explanation occurs there. Adèle C. Weibel a few years later identified this specimen, presumably Egyptian, Mamluk, 13th-14th centuries (Textile Museum, Washington, D.C., No. 73.480) as "byssus." To Weibel 'byssus' had obviously become mollusk byssus only. "True byssus," she wrote, "is probably the rarest type of woven fabric; this is the only specimen known to me. The name 'byssus' is sometimes used wrongly for very fine sheer linen or silk fabrics." (The fabric referred to is now known to be silkworm silk.)

W.L. Carmichael and others, in the Callaway textile dictionary, had *Byssus* as: (1) "A Greek term for the long filaments by which many species of sea shells and mollusks attach themselves to rocks"; (2) "Among the ancient Egyptians and Hebrews a variety of fine yellowish flax and cloth made from it."

H.R. Mauersburger, in the fifth edition of Matthews's textile fibers, refers merely to an old pot-boiler by Gilroy of the middle of the last century, whose Sea-silk account was plagiarized extensively from James Yates.

H. Wescher was of the opinion that cotton was sometimes meant when byssus was mentioned. I do not know if his claim that 'Byssos' was the early Hebrew name of a family of cotton weavers has been sustained by scholars. Overall, he had no doubt that byssos was a name for any finer-textured woven fabric.

Stephen S. Marks's edition of the Fairchild textile dictionary had *Byssus/Byssine* derived from the Greek word for 'Beard,' certainly a novel idea! The closest I can come in this regard is Latin, *Barbus*, 'Beard' – but that's not very close. This claim is repeated in Isabel B. Wingate's edition of Fairchild's textile dictionary.

Robert J. Forbes's study in ancient technology indicated no sympathy for the notion that Pinna's Sea-silk was byssus.

Franco Brunello's very good work on the art of dyeing is scholarly and reliable. While nowadays, the term byssus means the material called Sea-silk, Brunello writes, this was not anciently the case. He has some interesting things to say about the colors of ancient fabrics. There, it appears, the word 'byssus,' among other things, may have implied a color, possibly a special shade of purple. Something of the same sort goes back at least to the Greek philosopher Empedocles (ca. 490-430 BC) who, in an obscure fragment, used byssus in a perhaps parallel manner, although it is not clear whether he referred to a color, an intensity of color, or the ability of linen to accept saffron dye.

George Edward Linton's textile dictionary, while at least even-handed in listing "ecru-colored flax" and "linum byssinum" as well as Sea-silk still maintained that byssus comes from the Greek word for beard.

Hilda Ecsedy takes one laboriously through the labyrinthine history and pre-history of words related to 'Byssus.' With her story, one strays far indeed from Greece. There are, almost as an aside, some comments on how Pinna's Sea-silk may have become involved, although *not* as a name for Pinna's anchoring structure. Clearly, the word in its reference to any sort of fiber or fabric, for millennia had meant something of plant origin.

Kax Wilson's textile history lists *Byssus* under 'Animal Fibers,' thereby implying that Pliny was wrong to call it "a type of very fine linen," while other authors used the word for cotton and even used the word for "a particular shade of purple." "Most interesting is the byssus filament secreted by several bivalve mollusks." This stops short, however, of claiming that the word means exclusively Pinna's Sea-silk.

At mid-century, one gets the impression that byssus has become Sea-silk and little else. Thus, the *Enciclopedia Italiana di Scienze, Lettere ed Arti* is in good company – the word ‘bisso’ calls for an account of the biology and history of Sea-silk.

As I have already indicated, Stephanie Dalley has rather pulled out all the stops in a campaign to purge radically the history of byssus. For her, it seems to me, the word has come to mean little but Sea-silk.

References

Anon., 1944, *2000 Years of Silk Weaving*, p. 5, No. 35; see Textile Museum; A.C. Weibel.

Baines, Edward, *History of the Cotton Manufacture in Great Britain*, references throughout to byssus as a flax product; see especially his reproduction, with plate, of James Thomson’s “On the mummy cloth of Egypt,” pp. 534-543.

Beck, S. William, *The Draper’s Dictionary*, p. 39.

Bezon, Jean, *Dictionnaire Général des Tissus Anciens et Modernes*, pp. xlviii-xlix.

Bock, Franz, *Goldstickereien und Webereien*.

Brunello, Franco, *The Art of Dyeing in the History of Mankind*; this work of love has a great deal to say about use of color in the ancient world, with (pp. 323-394) a useful list of dye sources; p. 55, in Old Testament times, the “main colors cited are scarlet, hyacinth, purple and byssus,” with ‘byssus’ then being a color, perhaps (p. 56) a special shade of purple.

Buonanni, Filippo, *Ricreatione dell’Occhio e della Mente*, p. 156; the learned Jesuit knew nothing of Pinna in habitat and was sure the beard was a root with a nutritive function; as I have noted, he credited the fabric with being useful in treating deafness, not likely a view that he arrived at experimentally.

Carmichael, W.L., et al., *Callaway Textile Dictionary*, p. 58.

Chau Ju-Kua, his *Geography*, translated by Fr. Hirth and W.W. Rockhill, p. 141, 142.

Dalley, Stephanie, “Ancient Assyrian textiles and the origins of carpet design”; the main consideration of Pinna’s Sea-silk is to be found on pp.

121-122, and notes, p. 134.

Daremberg, Charles Victor, and Edmond Saglio, *Dictionnaire des Antiquités*; see 1(1): 235 for a documented discussion of *Amorgina*; *Byssus* is treated 1(1): 756.

Diderot, Denis, *Encyclopédie*, see 2: 471-472 for *Byssus/Bysse*.

Dobson’s *Encyclopaedia, Byssus/Byssum*, 3: 805, covers all bets and you take your pick of definitions; the account of Pinna and her Pinna-guard and the great enemy of Pinna, “the scuttlefish [!],” goes back to the ancients; much on capture, manufactures, etc., in the recent and contemporary Mediterranean.

Ecsedy, Hilda, “Böz – an exotic cloth in the Chinese Imperial court,” p. 145, byssos; p. 150-152, Pinna and the fusion of myths, East and West.

Empedocles, *Fragments*, pp. 123, 231.

Enciclopedia Italiana Di Scienze, Lettere Ed Arti, 7: 106.

Encyclopaedia Britannica, *Byssus* (fiber/fabric), 1: 697.

Faber, G.A., “Dress and dress materials in Greece and Rome,” p. 296, byssus is flax only; p. 297, the reference to Pinna’s Sea-silk does not use the word byssus for it.

Favart d’Herbigny, Christoph Elisabeth, *Dictionnaire d’Histoire Naturelle*, 1: 154.

Feen, P.J. van der, “Byssus.”

Forbes, Robert J., *Studies in Ancient Technology*, 1st ed., 4: 43; 2nd ed., 4: 43, 76.

Geoffroy, Claude Joseph, “Suite des observations sur les bézoards et autres substances”; *Pinna/Byssus* are treated pp. 206-207; 328-329 of the reprint.

Harmuth, Louis, *Dictionary of Textiles* (this is the Fairchild dictionary of 1915), *Byssine*, p. 29.

Hasselquist, Fredrik, *Voyages and Travels in the Levant*, p. 239, the old story of the cuttlefish as “the most inveterate enemy” of Pinna; he quite evidently believed the tale he had been told that “one or more crawfish (*Cancer pinnotheris*)” do duty as guards, etc.

Herodotus, *A Lexicon to Herodotus*, by J. Enoch Powell, p. 63.

Liddell, H.G., and R. Scott, et al., *A Greek-English Lexicon; Buthos/ Bussos, etc.*, pp. 333-334; *Pinna*, p. 1405, col. 2; *Tarentine (etc.)*, p. 1757, col. 2.

Linton, George Edward, *The Modern Textile and Apparel Dictionary*, 4th ed., p. 73.

Lutz, Henry F., *Textiles and Costumes among the Peoples of the Ancient Near East*, p. 3, *Byssus (flax)*; p. 20, *Bus*; p. 71, *Byssus factory*.

Marks, Stephen S., *Fairchild's Dictionary of Textiles* (1959), p. 92.

Mauersburger, Herbert R., *Matthews' Textile Fibers*, 5th ed., pp. 728-729.

Mendes Da Costa, Emmanuel, *Elements of Conchology*, pp. 62-63.

Panciroli, Guido (1523-1599), *The History of Many Memorable Things Lost, Which Were in Use Among the Ancients*, 1: 1-6, *Purple*; "the Silken Flax call'd *Byssus*," 1: 13-15; *Pinna's* "delicate Down" is treated on p. 14.

Passow, Franz, *Handwörterbuch der griechischen Sprache*, 1: 528, *Bussos*, *Buthus*; 2: 922, *Pinna*, etc.

Pauly, August Friedrich von, and Georg Wissowa, *Realencyclopädie*, Franz Olck on *Bussos*, 3(1), cols. 1108-1114.

Pausanias, *Description of Greece* (Frazer), 1: 242, 324, fine flax on Elis; again, 1: 424; notes, 3: 470-472; silk, 4: 110-112.

Pausanias, *Description* (Jones), 1: 401 3: 159, 161, 297, 299.

Pelliot, Paul, *Notes on Marco Polo*, p. 529.

Philostratus, Flavius, *The Life of Apollonius*, Book 2, Sec. 20.

Pollux, Julius, *Onomastikon*, pp. 741-743.

Rees, Abraham, *Cyclopaedia* (1805), *Byssus*, listed alphabetically, vol. IX.

Réaumur, Antoine de, "Les differentes maniers ..."; without (1711) as yet any experience with living *Pinna*s in habitat, he wrote of similarity of the *byssus* tuft to that of the common mussel, whose habits he was studying intimately; see pp. 125-126.

Réaumur, Antoine de, "Observations sur le coquillage ..."; on the shell called *Pinne marine*, or *Nacre de Perle*, with an explanation of pearls; p. 177, use of *Sea-silk* by ancients; p. 178, clearly, he had not yet seen the animal in habitat; fished up by a device called a *crampe*; it seems to me that he (or his engraver) shows *Pinna's* *byssus* as emerging at the hinge side of the animal in Plate IV.

Rondolet, Guillaume, *Libri de Piscibus Marinis*, vol. 1, *Pinna magna*, pp. 50-52; accepts Gaza's reading of Aristotle, p. 51; *Byssos*, of two sorts, etc., pp. 54-55; there is further reference to *Pinna's* *Byssus*, p. 55.

Textile Museum, Washington, determination by J. Herbert Waite that specimen No. 73.480 is silkworm silk; see Anon., 1944; Weibel.

Vial, Gabriel, "A propos d'une soierie faconnée, dite le 'Byssus' "; an analysis using microscopic study of cross-sections of fibers, etc.

Webb, Walter Freeman, *United States Mollusca, A Descriptive Manual*, pp. 6, 194; while the ancient Greeks used a word that is translated as 'Brissus' for a kind of sea-urchin and the word has been used taxonomically with reference to certain species of that group, there is no connection whatever with any species of mollusk; Richard E. Petit has been kind enough to comment on this matter.

Weibel, Adèle Coulin, *Two Thousand Years of Textiles*, p. 98, plate 71; see Anon. 1944, Textile Museum;

Wescher, H., "Cotton in the ancient world ..."; pp. 2324-2326.

Wilson, Kax, *A History of Textiles*, pp. 29-30.

Wingate, Isabel B., *Fairchild's Dictionary of Textiles* (2nd ed.), p. 91.

Yeats, John, *The Natural History of the Raw Materials of Commerce*, p. 338.

Zedler, Johann Heinrich, *Grosses Vollständiges Universal-Lexikon*, vol. 4, col. 2064, *Byssus*; vol. 28, col. 381, *Pinna*.

Naked, 'Though Fully Clad: Was Sea-Silk Ever Made Into A Diaphanous Fabric?

While a light step is appropriate, when so many experts are involved, it is now time to tackle the difficult question posed by my chapter title. My short-hand reference to a fabric that is more or less trans-

parent is that it is a "fine fabric." The term is ambiguous, of course, for any luxuriant, rich, sumptuous, intricately woven, highly embroidered or decorated fabric, often far from transparent, is a fine stuff. Here, my interest is in diaphanous, gossamer weaves, through which the wearer, further clad or not, can be clearly seen.

Blue-nosed moralists have the advantage in describing the effect of wearing diaphanous clothing, operating as they do from an iron-clad conviction that the proper condition of our kind is to be fully clothed. But it is hard to believe that only courtesans ever wanted (or needed) to display their charms. It is also easy to believe that a piece of cloth ten yards long and a yard wide that has cost a weaver five months' labor and yet is so flimsy that it will wear out in one night might appeal to a purchaser anxious to prove his worth.

Maybe, after all, the Emperor, in buying his New Clothes, had them made of just such gossamer stuff and the cost but reflected the fair returns of labor required for their manufacture? That he still appeared naked to viewers overlooks the possibility of his satisfaction in indulging in conspicuous consumption, whether he wished to be seen bare or not. I do not argue the merits of the Emperor's esthetic sense: I merely point out that the joy the iconoclast has in smashing idols and deflating egos may not have taken that sense into account in the tale that we know.

One thing that has bothered me about Stephanie Dalley's comprehensive study of Assyrian textiles is an implicit claim that the byssos that she claims as Sea-silks, unlike other fabrics of the time, was "almost transparent, so that the outline of body and musculature can be seen beneath." Thus, all that glistens is gold.

On the contrary, it seems to me that fabrics of sometimes extraordinary fineness have long been made, in several cultures, in different eras and places, using fibers of varied origins. Not that every spinner can spin such fine threads! However, at least some ancient workers could do just that. W.D. Cooke and Mohamed El-Gamal put it well: weavers of the famous Dakha (Dacca) muslins, within recent centuries, were capable of spinning yarns of a fineness "well beyond the commercial spinning limit of the highest quality modern cottons,

such as Egyptian fine, using the most sophisticated machinery." In addition to having refined spinning techniques and specially designed spinning machinery, particularly favorable local varieties of flax, cotton or wool may have been available to the workers.

Grace M. Crowfoot has produced an excellent, detailed study of the problem of fine folk spinning, with reference to Egypt and the Sudan. Her diagrams and illustrations will help to clarify this complex matter for those who can benefit from instruction. (I am not a spinner!)

Fineness of weave has often been treasured in materials made into clothing. The materials may not even be woven, much less of Sea-silk. For example, according to Robert Pierpont and others, there was a craze in the early 1800s for what were called "Limerick Gloves" and "Gloves in a Nutshell" – made in Ireland and Scotland of, most commonly, very fine kid or other leathers. They were usually sold stuffed into walnut shells, either real ones or gilded reproductions. I cannot help feeling that when Julia E. Rogers wrote that a pair of gloves, made of Sea-silk, "could be folded away in a walnut shell," she was in fact thinking not of Pinna but of "Limerick Gloves."

The story of cotton in India is a delectable feast. I cover the matter lightly. Shanti Swarup thinks cotton weaving goes back in India to the 3rd millenium BC; there are references to exchanges with the Mediterranean world as early as 400 BC. "In many early sculptures," Swarup writes, "women are represented both in richly embroidered brocaded robes and in muslin so fine as to fully expose their forms, and the lines of the folds of gold edgings traced across their bodies are the only evidence of their being clothed." There were delicate muslins, called *Ab-i-rawan* (Flowing Water) and *Bafte-hawa* (Woven Air) by the poets. "A rare muslin used to be produced in Dacca which when laid wet on the grass was rendered invisible, and because it thus became indistinguishable from the evening dew it was named *Shabnam*."

As for Indian apparel that could be seen through, a good many examples can be seen represented in paintings reproduced in a sumptuous book of court paintings by Pratapaditya Pal. Some of the filmy garments are worn by men and expose not the bodies but the fully

clothed person within the veil of fine outer wear.

A monograph on Indian cottons by B.L. Sethi and others may be pertinently cited. Cotton was being woven in the Indus valley 5000 years ago. Cotton goods were exported in quantity by 569-525 BC, and the Greek fine muslins called *Gangitiki* (from the Ganges) were treasured in the Western world. Quoting an annotator of Marco Polo (who traveled in India in the late 1200s), Sethi describes a spinner who worked with "a bamboo spindle not much larger than a darning needle, and rotated upon a piece of hollow shell to keep from breaking the thread," being able to spin a pound of lint into a thread with a length of 253 miles. John Forbes Watson illustrates such a spinner at work.

Popular repute has it that such diaphanous muslins as *Abrawán* and *Shabnám* were being made in India 2,000 years ago. Everybody agrees that today's weaving does not approach that level of excellence. T.N. Mukharji thought in 1888 that weaving of fine muslins was at the 'last gasp' stage, because machinery was unable to make such gossamer fabrics. Lack of economic incentive was also driving the art into extinction and a special long-staple cotton, no longer available, was needed. What must also be realized is that a piece one by ten yards cannot be woven in less than five months (William Ward in 1824, said that the period needed was four months) – and then only in the rainy season, when the moist air helped prevent breaking of threads.

Considering Mukharji's comments, it is interesting to hear from Charles Boewe that received wisdom in Pakistan has it that the Dakha craftsmen are today unable to produce diaphanous textiles because "the British cut off the thumbs of artisans," to reduce competition with foreign products. Still, a piece of Dakha muslin given me by Boewe (bought about 1965 but said to be perhaps at least 20 years older) is very fine. It is worth noting that Romila Thapar reports, on the highly organized industries of the time of the *Arthasastra* of Kautilya, that weavers were already considered "among the most unreliable of artisans." Thapar suggests that it was incorrect to say that the thumbs of dishonest weavers were cut off (long before the arrival of the British!): maybe it was nearer truth to say that their thumbs

were "mutilated," whatever that may precisely mean.

Marco Polo speaks of a delicate Indian fabric, translated by Yule as 'buckram,' whose pieces fetched very high prices, "in sooth they look like tissue of spider's web."

François Bernier, who traveled in the Mogul Empire in the years 1656-1668, wrote on "those fine muslins ... so delicately fine as frequently to wear out in one night. This article of dress, which lasts only a few hours, may cost ten or twelve crowns [a 'Crown of the Sun,' the coin of commerce and of a very considerable value at the time], and even more, when beautifully embroidered with needlework."

Jean-Baptiste Tavernier, who traveled in India at nearly the same time as Bernier, reported much the same: "There is also made at Sironj a description of muslin which is so fine that when it is on the person you see all the skin as though it were uncovered. The merchants are not allowed to export it, and the Governor sends all of it for the Great Mogul's seraglio, and for the principal courtiers. This it is of which the sultanas and the wives of the great nobles make themselves shifts and garments for the hot weather, and the King and the nobles enjoy seeing them wearing these fine shifts, and cause them to dance in them." "When returning from one of my voyages, I had the curiosity to take with me an ounce of thread, of which a livre's weight cost 600 mahmudis [which Tavernier's translator computed to equal 22 pounds 10 shillings, a very substantial amount of money], and the late Queen-Dowager, with many of the ladies of the Court, was surprised at seeing a thread so delicate, which almost escaped the view."

With characteristic disapproval of all that such fine Indian cottons meant, Tavernier's final conclusion was: "As for the finest qualities, they are of no use in Europe"!

William Bolts (Yule and Burnell cite him as 'Bolt,' creating a name that cannot be traced in printed bibliographies) summarized affairs about 1770 and described a muslin called *Abrooan* (as he spelled it), "manufactured solely for the use of the Emperor's seraglio, a piece of which, costing 400 rupees, or 50 shillings sterling, is said

to have weighed only five Sicca rupees." Bolts related two stories, widely current in Indian history. In one, "the Emperor Aurengzeba was angry with his daughter for showing her skin through clothes [some say that he threatened to send her to the harem]; whereupon she remonstrated ... that she had seven *jama*hs or suits on." In the other: "in the Nabob Allaverdy Khawn's time, a weaver was chastised and turned out of the city of Dacca for his neglect, in not preventing his cow from eating up a piece of *Abrooan*, which he had spread and carelessly left on the grass."

James Thomson reported in 1834 that he had found an Egyptian mummy-cloth (of linen) that certainly qualified as "fine" that had 100 hanks (a hank measured 840 yards) per pound – but had seen Indian cottons of 250 hanks per pound.

John Forbes Watson's study of Indian textiles and costumes (1866) has plenty of incontrovertible evidence that Indian cottons not only could be made into stuffs of extraordinary fineness: the very finest of European muslins could not equal them in virtually any way. Even in the matter of durability, the hand-made muslins are "proverbially lasting, and bear frequent washing" far better than the best English or European muslins do.

As with cottons in India, so it was with linens in Egypt: nowhere do you find any evidence, in matters of fineness, that there could have been any felt need for a substitute, Pinna's Sea-silk or otherwise. Indeed, I suspect people only happened upon Sea-silk well after the wonders of silkworm silk from the Orient became known – and after the economic burden of supporting importation of the latter became unbearable.

Whether byssus was ever cotton elsewhere is an academic question: in Egypt, early and late, it seems likely to have been linen alone. James Thomson firmly forwarded this conclusion in 1834, citing mummy-wrappings all of which were linen and some of which would qualify as fine. G. Schaefer has written a history of the looms in Egypt that made possible the excellent workmanship in textiles to be found there. He reports evidence of weaving and looms in Egypt by about 3400 BC. "The fragments of cloth belonging to the First

Dynasty are of surprisingly fine quality, and we are told that in the Sixth Dynasty there were robes of so delicate a texture that they could be drawn through a signet-ring. The so-called Byssus fabrics, which were said to cover the body and at the same time to enhance its lines, were affected by the nobility."

Henry F. Lutz's masterful account of flax in Egypt must be consulted for its rich detail of lexicographic and technical history. He reproduces several notable illustrations that show diaphanous garments, through which body outlines can be clearly discerned. I think it highly unlikely that many (if, indeed, any) of these show garments made of Sea-silk. In fact, Egyptian artisans knew well enough how to make diaphanous textiles, even when they started with the closely textured Chinese silks: they raveled out the threads and rewove them, or they took needle in hand and loosened and stretched out the web of the fabric. (See also Crowfoot's interesting study.)

There was plenty of interest – negative and positive – in gossamer fabrics in Greece, and no indication from any angle of natural history that Pinna and Sea-silk were involved. Cratinus (ca. 495 - ca. 420 BC) makes salacious remarks about a maiden, 'wantoning in unbleached muslin.' Clearly, 'muslin' here is a word from our time; it is an effort to convey the proper sense of a word. Consider use of the word 'silk' for the ancient 'byssus' in an early translation of the *Bible* – the latter would be meaningless to a contemporary reader, while 'silk' has an odor of sanctity all its own in conjuring up notions of a rich fabric.

Aristophanes, in "The Lysistrata" (411 BC), wrote of saffron silk (one wonders!) and robes of gauze; *Amoriginois* (amorigina) becomes "daintiest lawn" in modern parlance; again, a similar word is "lovely flax" and, simply, "flax." But Aristophanes knew about Pinna and the Pinna-guard. If Pinna's Sea-silk had been the source of any of these fabrics, he would have acknowledged it.

Menander of Athens (ca. 342 - 292 BC), in "The Arbitrants," wrote of what is translated as "silken Tarentine" – the final word triggering the modern annotation, drawn (quite without proof) from Liddell and Scott, that Pinna's Sea-silk was meant.

Nicostratus (4th century BC) wrote of a thin, diaphanous textile that the translator could only term "Tarentine cloth" to convey his meaning.

Athenaeus, a Greek native of Naucratis, Egypt, who flourished about 228 AD, deep into food and conversation and the quotation of old authors, wrote in "The Deipnosophists" of several matters of interest to us. He knew his Aristotle and other Greek authors – and clearly knew nothing of Pinna as producer of a fabric, fine or otherwise. As for diaphanous fabrics, one of his contributors is made to say, in reporting on a sumptuous feast at a wedding ceremony: "When we had at last pleasantly taken leave of all sobriety, there entered flute-girls and singers and some Rhodian samubuca-players. To me these girls looked quite naked, but some said that they had on tunics." His *Amorgina* has been translated as 'mallow fiber' and, later, as 'silk,' the translator in neither place willing to bet on Pinna.

Alciphron (1st to 2nd century AD) did know about 'Sea-wool,' perhaps because of some accident of local geography. His fishermen told of "sea-wool," presumably produced by Pinna (he is not explicit in this regard), "which grows expressly for a spoiled darlings's summer robe." This certainly implies its use to make into a fabric that had some degree of class. Some commentators have thought that his "Tarentine wrap," a sort of badge of the courtesan, was a reference to material made from Pinna's Sea-silk but this is pure guess-work.

Philostratus the Athenian (ca. 170 - 245 AD), presumed author of "Love letters," wrote of "rouge and wax and Tarantine wraps and serpentine bracelets" as sorceries – the modern translator supposing that 'Tarantine' implies cloth made of Sea-silk, but definitely without proof.

The production of gossamer fabrics, in any case, was common. The 11th edition of the *Encyclopaedia Britannica* for example, speaks of a kind of native silk that was made into "Coa vestis, which revealed rather than clothed the form." That, surely, most succinctly exemplified the intent of the wearer.

Hermann Julius Meyer carefully distinguished between various kinds of byssus (none of it Pinna's Sea-silk). As far as I can see, he was on firm ground when he identified the precious yellow byssus of Elis as being a non-mollusk fiber. From it, he wrote, were made 'clothes, hair nets, etc., enabling Roman ladies to preen themselves.'

And, everywhere, there was an interest in flimsy fabrics. Daremberg and Saglio write of *Amorgina*, 'rivaling the fineness and the transparency of *Byssus*, made probably with a sort of flax cultivated on the island of Amorgos, one of the Cyclades.' It was used, 'so it seems, almost exclusively for the dresses of women, and was much sought after in Athens and dearly priced about the Vth to the IVth centuries BC. *Amorgina*, independent of the beauty of its weaving, was distinguished by its red or purple color.'

Standard accounts of woollens, linens, cottons and silks treat the history of textiles in the Roman world. Here, I try to keep my attention to a few notices of flimsier textiles.

There was an interest in such diaphanous stuffs, whether home-grown or not, whatever the fiber constituting them. Horace (65-8 BC) sniped at flimsy garments made of "silk from Cos" (that is, silk gathered from wild native silkworms). His argument that such textiles were worn to display the charms of the wearer was perhaps correct: any intimation that only prostitutes had such an interest may be overdrawn. Seneca (ca. 4 BC - 65 AD), for example, issued a vigorous blast at all wearers of silk, but obviously referred to Chinese domesticated silk – "imported at great expense from nations unknown even to trade." They left women appearing to be naked, he charged. It was not courtesans alone: even "our married women" were guilty of such vanities.

Pliny knew nothing of any fiber originating with Pinna, although he was well acquainted with Pinna and the records that writers had left of it. However, he knew well the predilections of Romans, men and women, for finery, including textiles of great fineness. His account of linen is minutely detailed. Linens of Retovium "are supremely fine in texture and substance and are as white as the Faventia This flax makes a tough thread having a quality almost more uniform than

that of a spider's web, and giving a twang when you choose to test it with your teeth." In Spain, the linens of Tarragon were known for their fineness. "The flax of Cumae in Campania ... is used as a material for making hunting-nets; ... the Cumae nets will cut the bristles of a boar and even turn the edge of a steel knife; and we have seen before now netting of such fine texture that it could be passed through a man's ring, with running tackle and all, a single person carrying an amount of net sufficient to encircle a wood!" Thus, Pliny was not unaware of fine fibers, nor averse to characterizing them quantitatively, as shown by his counts of threads in nets.

While one might twit Pliny for his confusion of the mineral asbestos with a kind of linen, in truth, in his day a cloth was made of it. Despite the shortness of its fibrils, it was spun and woven into a novelty fabric. It could be cleansed by throwing it into a fire, from which it emerged in pristine condition. (An unusual early American interest in asbestos fabrics is documented by Clifford Frondel.)

Asbestos, Pliny reported, for the reason just cited, was highly prized: but the next highest rank was given "to a fabric made of fine flax grown in the neighbourhood of Elis in Achaia, and chiefly used for women's finery: I find that it formerly changed hands at the price of gold, four denarii for one twenty-fourth of an ounce."

Although he knew of Pinna's Sea-silk and agreed that it was somehow involved in the price-fixing scheme of the Roman Emperor Diocletian, Tenney Frank found no evidence of its general use in the economy of Rome. Still, a great abundance of diaphanous textiles was produced. The wools of Taranto (Tarentum) were notably fine and beautifully done. They were, he noted, "mentioned *ad nauseam*." "A manufacturing industry, far more expert than ordinary household production, must have developed in these regions since some of the Tarentine product was exceedingly delicate" (it was called diaphanous, Frank notes). Frank continues: "it is unlikely that the very fine textiles we notice on the wall-paintings of Pompeii represent homespun fabrics. Some of them are, of course, silks, linen, and cotton fabrics that had been imported from the East; others possibly came from the best of the Italian 'factories.'" A note adds: "The best clothing, especially for women, seems to have been imported: sheer, all and part silk

from factories at Cos in Asia Minor ..., fine linen from the old hieratic factories of Egypt" Frank notices references in literature "to the very delicate fabrics produced." The spinning and weaving must have been done under careful supervision, with the use of the best equipment and artisans, "that is, in factories. This is true especially of articles called diaphanous."

M.-Th. Schmitter's careful study of silk-like materials (fibers and textiles) in history and archaeology, particularly as reflected in prices allowed by Diocletian's price-edict, shows that several sorts and grades of materials were used in the Rome of that time. However, Schmitter's acceptance of what appears to be 'subsilk' ("subsericae vestes") for Pinna's Sea-silk seems to me no proof at all that it was used to produce an exceptionally fine yarn or textile, however desirable or silk-like it was.

Edward Gibbon noted the popularity of superfine fabrics and diaphanous garments in Rome – the popularity of foreign goods cannot have much helped the economic health of the declining Empire!

Along with much else of interest, E.H. Warmington confirmed the importance of imported fine fabrics in the life of the Roman Empire. Aside from pearls, there were muslins from India, then, from at least the 1st century AD, both true silk (ultimately from China, until its secret introduction into the Mediterranean area in Justinian's reign) and native wild silk used in the production of Coan silk.

St Eustathius, Archbishop of Thessalonika (fl. 1175; his dates are perhaps 1130-1195), referred to a fine cloth in his *Grammaticarum in Dionysii* under his term *Amorgina*. I cite it here only because, to some recent writers, anything referring to a fine fabric has been taken to mean made of Sea-silk. I doubt its pertinence to our subject.

Otto Keller's account of the ancient animal world reports Manuel Philes (a Byzantine poet, ca. 1275-1345) as writing that from the Sea-silk of Pinna were woven nets as fine as cobweb that, when woven into the golden curls of girls, made them irresistible to boys: one of the few claims of which I am aware that refers to Sea-silk as producing a diaphanous fabric. What Philes's qualifications were for

expounding on Pinna I do not know. He seems to have set out to write a popular version of the ancient bestiary. Perhaps he got most of his information, in the spirit of the times, from earlier writers – I suspect that he combined the stale old accounts of Pinna with the moralists' railings against flimsy fabrics: and, with a certain literary license to boot, added Pinna's name to the result.

At a later date, a notable documentary account of the use of Sea-silk at Taranto was left by the traveler R.U. von Salis-Marschlins. His tour of southern Italy took place in 1789. There was a considerable industry in use of Sea-silk at Taranto only (workers there even went as far as Sardinia and Corsica to secure Sea-silk). After mixing it with perhaps one-third real silk, in order to strengthen it, it was knitted (*not woven!*) into various items, "even whole garments," but he makes no claim to have seen any that were in any way unusually fine. And, with all his desire to credit local observations, he was skeptical that Sea-silk was the byssus of the ancients. He also cast a calculating eye at claims by commentators C.A. Carducci and Father Antonio Minasi upon the 'Deliciae Tarentinae' (see Aquino) that "the glossy light garments worn by the dancing women, as they are represented in the paintings at the Museum at Portici, and which were called Tarantinidie, were made of this silk." (I have not identified the paintings that may have been referred to; but if the fabrics in question were as diaphanous as the gossamer robes of 'Chloe' and the 'Three Graces,' in Botticelli's "La Primavera," I can well see how the mind of Aquino's commentator, Father Antonio Minasi, was turned to thoughts of spider-webs and 'Tarantine.' But these so nearly duplicate the fine fabrics recorded in illustrations from India and Egypt, as well as descriptions left by Greek and Roman writers, that I cannot seriously believe they were made of Pinna's rather uneven [and not extraordinarily fine] fibers.)

Peter Lund Simmonds was fairly well informed in regard to Pinna and Sea-silk. He rather over-did the fineness of the fibers. However, his only pitch for a fabric of a truly diaphanous nature is the recounting of the claim that in 1754, a pair of stockings made of Sea-silk was presented to Pope Benedict XIV, "which from their extreme fineness, were enclosed in a small box about the size of one for holding snuff."

Whether stockings given to Pope Benedict may still exist, among paraphernalia preserved at the Vatican, ought to be checked. Beyond that, a pair of stockings (presumably full length?) that might fit into a snuffbox seems no more wonderful than a pair of "Limerick Gloves" of leather that could be squeezed into a walnut shell. The stories, in fact, may be of a piece.

In our century, H.G. Liddell and R. Scott accepted "Tarantine" as a "garment made of a diaphanous material woven from the byssus of the pinna." I think the definition can be dismissed as an example of historical syncretism.

Pietro Parenzan has written an interesting history of Taranto and, of course, in his natural history of Pinna, makes much of what he perceives as connections between Taranto and its industries based on mollusk purple and Tarantine cloth, which he then assumes to be made of Pinna's Sea-silk, giving the usual classic references. Its full account of both history and natural history owes much to Aquino's *Delle Delizie Tarantine*.

I have recently been favored with a paper by its author, Giacinto Peluso, 'The byssus industry in Taranto from tradition and history.' It is an important work. I cannot see that he makes many claims for extreme fineness of fabrics made of Sea-silk. He accounts most uses known to him to be knitted. Historically, he does incline to accept the claim that Tarantine cloth was made of Sea-silk. However, those claims are mostly based upon commentaries upon Aquino and they remain to be substantiated. He lists possible useful clues to location of textiles in repositories in the Vatican and elsewhere. These decidedly deserve thorough, scientific investigation.

References

Alciphron (1st to 2nd cent. AD), *The Letters of Alciphron ...*; p. 43, "sea-wool," an apparent reference to Pinna and Sea-silk; however, a courtesan's complaining reference, p. 271, to her "ragged old Tarentine wraps" hardly qualifies as a guaranteed reference to anything made of Sea-silk, whatever the modern annotator says.

Aquino, Tomasso Niccolò d', *Delle Delizie Tarantine*; annotated by Cataldanton Atenisio Carducci (his forenames are variously spelled, where he is

noticed at all); with some information on the natural history of mollusks being supplied by Father Antonio Minasi; this obscure work was fortunately reprinted in 1979; however great the bulk of this work (and it comes to some 550 pages), neither Aquino nor Carducci are noticed in the huge *Dizionario Biografico degli Italiani* (the letter 'M' not yet done, so perhaps there will be some notice of Minasi); I have put what information I have on Carducci and Minasi under their names, below; according to Salis-Marschlins, Father Minasi was responsible for annotations regarding mollusks, including claims that Tarentine cloth may have been made of Sea-silk; Sea-silk ("Lanapenna") is mentioned on pp. 260, 261, 262, 496; "Pinna" is not in the index, nor is there any reference to Father Minasi, although he is given general credit, p. xxiv; Salis-Marschlins held the work to be, except for the contributions of Minasi, "a vast mass of unprofitable erudition"; for an excellent reproduction of Boticelli's painting, "La Primavera," see *Uffizi Gallery*, 1968, p. 60-63.

Aristophanes, "The Lysistrata" (411 BC), *Amorgina*, etc., translated as "daintiest lawn," "lovely flax," "flax"; whether any are to be truly translated as saffron silk or robes of gauze, I don't know; see lines 150, 735, 737.

Athenaeus (2nd-3rd cent. AD), *The Deipnosophists*; for the marriage celebration, see 2: 91-93.

Bernier, François, *Travels in the Mogul Empire*, p. 259.

Boewe, Charles, letter 1 De 1994.

Bolts, William, *Considerations on India Affairs*, p. 206, he notes that works of his time were incomparably less fine than those of former days.

Carducci, Cataldanton Atenisio, annotator and translator into Italian of a Latin work by Aquino, which see.

Cooke, W.D., and Mohamed El-Gamal, "Ancient textile technology - the hand spinning of ultra-fine yarns," see especially p. 69, but throughout there is much elegant information on spinning of fine threads.

Cratinus (ca. 495 - ca. 420 BC), *Fragments of Attic Comedy*, pp. 24, 25; 26-27; some muslins were commonly sold unbleached - see Pliny, 5: 427, where linens of Alia are so described.

Crowfoot, Grace M., "Methods of hand spinning in Egypt and the Sudan"; kinds of hand spinning, p. 8, a good work throughout.

Dalley, Stephanie, "Ancient Assyrian textiles and the origins of carpet design," p. 122-ff.

Daremberg, Charles, and Edmond Saglio, *Dictionnaire des Antiquités Amorgina*, 1(1): 233.

Encyclopaedia Britannica, 11th ed., 25: 97, a reference to Coan silk.

Eustathius, Saint, Abp. of Thessalonika, *Dionysii Orbis Descriptio*, a reference to a fine cloth, called *Amorgina*; see Daremberg and Saglio.

Frank, Tenney, et al., *An Economic Survey of Ancient Rome*, pp. 164, 165, 202.

FrondeL, Clifford, "Benjamin Franklin's purse and the early history of asbestos in the United States."

Gibbon, Edward, *The History of the Decline and Fall of the Roman Empire*, 6: 67; this has been quoted at greater length in the chapter on early Christian knowledge of Pinna.

Horace (65-8 BC), *Satires, Epistles and Ars Poetica*; in 'Satires,' p. 27, he contrasts "the matron" with "the other" (the courtesan or, in plainer language, prostitute); in contrast to the matron, hemmed in by all manner of barriers, "In the other - no obstacle. In her Coan silk [which the translator has as 'A kind of transparent silk made in the island of Cos.'] you may see her, almost as if naked, so that she may not have a poor leg, an unsightly foot; you may measure her whole form with your eye."

Keller, Otto, *The Antike Thierwelt*, 2: 549, a brief reference to Philes.

Liddell, H.G., and R. Scott, *A Greek-English Lexicon*, p. 1757.

Lutz, Henry F., *Textiles and Costumes Among the Peoples of the Ancient Near East*, fineness of linen, pp. 52, 105-7; illustrations, pp. 114, 115, 116, 117.

Menander (ca 342-292 BC), "The Arbitrants," line 272, p. 63, a reference to a silken fabric that the translator identifies, upon the strength of definitions by Liddell and Scott, as Tarentine, a diaphonous textile possibly made of Sea-silk.

Meyer, Hermann Julius, *Meyers Konversations-Lexikon*, 3: 706.

Minasi, Antonio, Dominican friar of Scilla, Kingdom of Naples; if we are to believe Salis-Marschlins, he was a worthy naturalist, with considerable ex-

pertise in the study of mollusks, whose real worth was not much advertised by translator and editor Carducci (see Aquino); Charles Boewe believes that his life dates were 1736-1806; references even to his works are miniscule; none in Watts; in Engelmann, p. 707, his name is spelled 'Minassi'; C.D. Sherborn, *Index Animalium*, has an "A. Minassi" who is said to have publ. "Diss. de Timpanetti," Naples, 1775: a work on the 'Fata Morgana'; Salis-Marschlins, pp. 438-439, plus many short citations; Henry Swinburne (1790) notes Minasi's help with a list of species of shellfish, pp. 74-76; pp. 264-265, notice of Minasi's account of the Fata Morgana; p. 222, a reference to his heroic behavior in a struggle of townfolk of Scilla with the local prince.

Mukharji, T.N., *Art-manufacturers of India*, pp. 315, 316, 318, 319.

Nicostratus (4th cent. BC), lines 37-40, 2: 42, 43, Tarentine cloths, thin, diaphanous.

Pal, Pratapaditya, *Court Paintings of India*, many filmy garments shown in paintings, sometimes worn by men over other clothing.

Parenzan, Pietro, *Il Mar Piccolo di Taranto*, a good historical study; Pinna and its "Bisso," pp. 205-211.

Peluso, Giacinto, "L'industria Tarantina del bisso fra tradizione e storiografia," an excellent work, fully documented; his references to any fabric that could be called diaphanous are entirely by way of literature.

Philes, Manuel, *De Animalium Proprietate*, p. 323-ff; there is a brief notice of this in Keller, p. 549.

Philostratus ("the Athenian"); see *The Letters of Alciphron, Aelian and Philostratus*, by A.R. Benner and F.N. Forbes, p. 463.

Pierpoint, Robert, et al., "Limerick gloves in a nutshell," etc.

Pliny, *Natural History*, much on flax. vol. 5, pp. 425-437; Alian flax, sold unbleached, p. 427; fine netting, etc., p. 427; asbestos, "incombustible flax," p. 433.

Polo, Marco, *The Book of Ser Marco Polo*, 2: 348, 349, 'buckrams ... like tissue of spider's silk'; Yule's reference to diaphanous muslins in *Journal of the Asiatic Society of Bengal*, 6: 1086, appears to be faulty.

Rogers, Julia E., *The Shell Book*, p. 403.

Salis-Marschlins, R.U. von, *Travels through various Provinces of the Kingdom of Naples in 1789*; references to Aquino's 'Deliciae Tarentine' (as he calls it), pp. 160, 439, 451, 510; account of Pinna, etc., pp. 505-510; his list of mollusks, pp. 435-513, is a notable work.

Schaefer, G., "The principle of the loom," p. 546, 552; much of significance.

Schmitter, M.-Th., "Subsericae vestes," various pages, including pp. 214, 215.

Seneca, *Moral Essays*, 3: 479.

Sethi, B.L., et al., *Cotton in India / A Monograph*, 1: 1, 2, 3, 3-4.

Simmonds, Peter Lund, *The Commercial Products of the Sea*, p. 308.

Swarup, Shanti, *5000 Years of Arts*, p. 213, age of cotton weaving in India; p. 214, history of exchanges; reference to Pliny, p. 214; p. 218, references to delicate muslins.

Tavernier, Jean-Baptiste, *Travels in India*, 1: 46-47; 2: 6, 7.

Thapar, Romila, "State weaving-shops of the Mauryan Period," overall; p. 59, reference to mutilation of thumbs of weavers.

Thomson, James, "On the mummy cloth of Egypt," p. 358, 360.

Ward, William, *A View of the History, Literature, and Religion, of the Hindoos*, p. 102.

Warmington, E.H., *The Commerce Between the Roman Empire and India*, see pp. 172-173, 174-175.

Watson, John Forbes, *The Textile Manufactures and the Costumes of the People of India*, fineness, pp. 61-62, see plate; the spinning technique is illustrated in a plate following p. 64; fine muslins, pp. 75-76.

Yule, Henry, et al., *Hobson-Jobson*, pp. 705-706.

Science Demonitizes Pinna And Cripples The Pinna-Guard
In our day, byssus (however spelled) has become an excrescence of a bivalve mollusk. That of Pinna, especially, has little currency, scientific or otherwise. An interest in certain bivalve byssus fibers is suddenly keen but not for their rich historical connections.

Nobody believes the fable of the Pinna-guard. The magic of Pinna has been devalued. *Pinna*, the textbooks tell you, is a generic name, to be capitalized and italicized as the fore-part of a dog-Latin binomial. A culture that sneers at nomenclatural science demands a proper common name. So, its ages-old common name of Pinna is little known and we have Pen-shell or Fan-shell – the former especially not very informative, for we do not now write with quill pens.

Not one hand-weaver in a thousand has heard of spinning and weaving a fabric, gossamer or otherwise, from Sea-silk. The record is probably little better among practical textile experts.

One cannot much regret the loss of belief in easy fables, if it is replaced by rich observational lore and deep knowledge of ancient beliefs. This, by and large, has not happened.

We have gradually lost contact with what authors once deemed the real world, however arid their knowledge of it was. Recapturing that early vision is no easy task for our scholars, getting no closer to nature than a compendium of classical allusions, most of whose authors did much the same. Nor do we any longer even think it worthwhile to compose long, high-flown Latin verses listing all known (that is, named) animals and their alleged attributes. That approach is as dead as our interest in the endless litany of 'begats' in the Old Testament.

Not that the genre died easily. Take the case of Nicolò Partenio Giannettasio (1648-1715). I stumbled upon him in a traveler's potboiler by Arsenne Thiebaut de Berneaud, himself anxious to keep up appearances of a respect for ancient learning. The latter, in his account of a voyage to the island of Elba in 1814, wrote that Nicolò Partenio, 'under the pseudonym of Giannettasio,' wrote in the "Halicutica" (!) an account of the wars between Muscardino (an octopus) and Pinna marina, the former being the inveterate enemy of the latter.

In his long, difficult recounting in Latin of the riches of the sea, Giannettasio tells of all the animals that one might meet on a visit to the sea in the Mediterranean region, according each its oft-told history. There is no English version of his tale, but he appears to

have left out few stories that he had gleaned from the authors of the past. His account will repay further study, for he describes a contraption to fish up Pinnas – without making it clear to me the purpose of the fishing.

Ogier Ghiselin de Busbecq, in the previous century, took a different approach. Along with some sign of real observation, he espoused a healthy skepticism. While vacationing (a virtual prisoner as ambassador to the Turkish sultan, on the Sea of Marmora, principally the island of Prinkipo, in the Princes' Islands), he allowed his keen mind to wander. His freedom was uninterrupted – so long as he did not attempt to leave.

As for Pinnas, Busbecq fished them up in plenty, using "a pole and iron contrivance made for the purpose, with which I pulled them up from the bottom." Obviously, the *crampe*, or a version of it, was already known and in use. Pinnas "are very plentiful in that sea, so much so that they seem to have been artificially laid down. I found in them the pinna-guards, celebrated by Cicero, Pliny, and Athenaeus, which were usually in pairs, a male and a female [surely, a dubious assumption?], but sometimes in larger numbers. I am afraid, however, that the other statements made about them by the authors are not altogether to be trusted." (He then recounted the standard folklore.)

Pinna, Busbecq went on, "fixes the sharper of its two ends into the bottom of the sea, and fastens itself by a tuft of hair or thread, so firmly, that one might think it was planted there. By these threads it sucks up its nutriment, which is clearly proved from the fact that, if torn from its place, it dies from want of nourishment, like vegetables and plants when severed from their roots." He was cautious: "But it is probable the pinna-guard chooses this home in order to have a strong defence against the violence of ravenous fishes and a quiet haven when the sea is boisterous I should not, however, wish in saying this to be suspected of intending to detract at all from the authority of such great men; my object is simply to draw the attention of others to the subject in the hope of its being investigated more thoroughly. We used to have no difficulty in filling our boat with pinnas; they are not good eating, and you would soon get tired

of them, being coarse and tasting like mussels. But the fishermen told us to pick out the pinna-guards, of which a dish was made, that was alike agreeable to the palate and wholesome for the stomach."

The pinna-guard fared even less well under the calculating eye of Claude Joseph Geoffroy (Geoffroy the Younger) in 1712. Possibly, in fact, Geoffroy was a bit unfair to the ancients, in his retelling of the wonders attributed to the Pinna-guard. He had no use for any of the variant stories: whether Pinna lured fishes inside and the crab nipped her to tell her that dining for both was at hand; or if the crab put a pebble in place to prevent Pinna's closing while it helped itself to the fishes that Pinna had captured. (Indeed, the pebble game was usually held by the mythologists to be played by a clever octopus to prevent the mollusk's closing, so that he could feast at leisure on Pinna's flesh.) 'All these examples,' Geoffroy asserted, 'are fabulous. The little crabs that lodge themselves in the shell of Pinna, are present indifferently in all other bivalves ... where one meets also sometimes little shells that come inside, or that attach themselves upon the outside. ... besides, the fish of the shell [the Pinna animal] does not live on flesh, any more than mussels and oysters, but solely on water and ooze; thus, the skill of the little crab would be useless to it: and finally, these little crabs don't eat the fish of the shells where it lodges itself, since one finds these fishes sound and whole, with the little crabs that accompany them.'

He concluded: 'It is only chance that these little animals dart into the shells when they are open, or that they merely retire there for sleeping and cover, as one finds them very often in holes in sponges and rocks and in external cavities of shells.'

In 1745-1752, a gullible young friend of the great Linnaeus, Fredrik Hasselquist, toured the Mediterranean on a natural history pilgrimage to the Holy Land. He obviously supplemented whatever observations he may have made by a generous sampling of ancient stories. His journal of the voyage so impressed Linnaeus that he published it after Hasselquist's unfortunate early death. Of Pinna, we learn that the cuttlefish (not the octopus this time, although this word may be a guess by the translator) "is the most inveterate enemy of this animal." Further: "One or more Crawfish [this is the English trans-

lation: crab would no doubt be correct] (*Cancer pinnotheris* [sic])" do duty as guards. Etc. He believed it and, we are to suppose, so did Linnaeus (Chemnitz, to be cited below, had it that Linnaeus, his great idol, had been 'seduced' by Hasselquist). A possibly sounder statement, at least with some claim to be an observation, even if a negative one, indicated that he had not seen any evidence of Pinna's byssus silk being used to make a fabric.

Hasselquist's welcome confirmation of ancient wisdom was instantly siezed upon by another Linnaean student (actually, Linnaeus is conventionally and perhaps properly credited with writing his accounts), Isac Isacson Biberg. In his "*Oeconomia naturae*" (it would be called ecology today), he related that an octopus is the most hostile enemy of Pinna. Rapacious as a lion, he is prevented from devouring the open Pinna except for the alertness of a naked but eyed crab. 'This most wonderful phenomenon was seen by the most learned D.D. Hasselquist' who had thus confirmed and updated the wisdom of the ancients.

Count Giuseppe Ginanni's posthumous list of supposed species of Pinna in the Adriatic appeared in 1757. It is of no concern with respect to Sea-silk.

According to my reading of Chemnitz, Petter (Pehr) Forskaal (1732?-1763), also a traveler in the Middle East, told of checking Pinnas and finding no crabs. This may be true but his reports on various supposed species of Pinnas (listed under "Vermes") and of crabs ("Insecta") are rather garbled and I cannot make out such a statement.

Diderot's *Encyclopédie*, ever anxious to doubt authority, followed Geoffroy to the letter in regard to the Pinna-guard. There is, again, the curious fusion of fables, so that some are credited with supposing the crab born with the Pinna; others imagine that the crab must exercise the caution of putting a pebble between the shells of the bivalve when it goes forth to fish, so that it can return without mishap.

The Rev. Johann Hieronymous Chemnitz seems to have read all the authors before penning his notable account of 'Pinna and its silk,

as also the Pinna-guard.' There is but little on Pinna and its silk. Two-thirds of the essay is expended dissecting the story of the Pinna-guard, attacking even Aristotle for picking up an old tale, others for repeating it. Hasselquist, as already noted, 'seduced' Linnaeus.

Chemnitz's contribution on Pinna in Friedrich H.W. Martini's great conchological monograph is negative in regard to the Pinna-guard.

Karl Ulysses von Salis-Marschlins, in his report on travels in the Kingdom of Naples in 1789, produced a good many fresh observations, together with a notable catalog of shells, but was reluctant to abandon the old story of the Pinna-guard. "Many fishermen assured me that they have frequently taken notice of the shrimp [this is the English translator's term], which is constantly in the neighbourhood of the pinna, but does not keep within it, and is known by the name of the pinna's sentinel." He had clearly not carefully observed the matter himself - but the stories he heard were the usual ones: the inveterate enemy, the polypo (which the translator takes to be the cuttlefish but is properly an octopus); the danger that a closing Pinna might sever a finger; the stone that the "sepia" puts between Pinna's valves; etc. He is aware that Chemnitz treats all this "as a ridiculous fable." "But so many respectable old fishermen, who have passed their lives upon the sea, have so earnestly assured me of the contrary, that the truth is still in my mind undecided."

Dobson's American version of the *Encyclopaedia Britannica* showed little of the independence of mind that characterized Diderot's *Encyclopédie*: "the scuttlefish (sepia) ... is a deadly foe" to Pinna. All the old authors are trotted out, having been vindicated by the thoroughly modern Hasselquist.

At the end of the century, Benjamin Henry Latrobe, obviously intent on gathering material for a bestiary to end all bestiaries, jotted down his thoughts: "The Oyster, called the *Byssus* fixes himself to a rock, and receives into his Shell a little kind of Crab, with whom he lives, and carries on business in partnership. The *Byssus*, is provided with a very long hairy beard, which he can put out or collect within his shell. Upon this beard, the *Byssus* suspends himself, using it as a rope ladder. The Crab gains the fortress of the Shell, whenever any

danger approaches and he rambles after foot [food]. If he catches any thing, he takes it into the shell of his protector, and they dine together upon it. Every *Byssus* has his Crab, and their operations have often been watched." At his first use of the term *Byssus*, Latrobe inserted: "The name of the Oyster in Linnaeus is Pinna. The *Byssus* is the name given by the ancients to his silky beard." Latrobe obviously thought his name ought to take precedence over that of Linnaeus. But even aside from the nomenclatural rule that valid zoological names began with Linnaeus in 1758, his thoughts lay long in manuscript, and no one else ever proposed the name *Byssus* as Latrobe used it.

James Russell Lowell, traveling in Italy, must have heard the Pinna/Crab story. He noted in a journal entry that he did not want his "oyster" existence of sedentary contentment disturbed by the invasion of crabs that, as *parasites*, would "insert themselves as his inseparable bosom companion."

Levrault's *Dictionnaire des Sciences Naturelles* carried accounts of Pinna and the weaving of its byssus.

By mid-century, Eduard Friedrich Poeppig brought out a modern natural history, merely spiced with the old stories that were dismissed as fables from the ancient world. Edmund Brehm's *Tierleben* also took the old stories to be just that and supposed that the crab, with its soft exoskeleton, was seeking protection. Both *Pinnotheres* and a shrimp *Pontonia* were treated. P. Harting wrote a useful account of the usual matter on Pinna and Sea-silk for readers of the popular Dutch periodical *Album der Natur*. Pinna's internal anatomy was skillfully drawn in 1857 by Marie-Emma Gray.

Rather unaccountably, Count Angelo de Gubernatis, in a comprehensive account of animal mythology, had nothing at all to say of either Pinna or Pinna-guard. Whatever you make of this, it did mean that Pinna had ceased to matter as much as it had in the days of Aristotle and Pliny.

Thomas R.R. Stebbing's classic account of crustaceans mentions both *Pontonia* and *Pinnoteres* (as he spells it), whose association with

Pinna was recorded by Aristotle. He had little sympathy for the old stories but thought that perhaps the commensals did little harm to the mollusk. William Thomas Calman's story of crustaceans made little of *Pontonia* and reduced *Pinnotheres*, the pea crab, to a life-sized illustration. Far from being alert and useful guards, Calman noted, "the eyes and antennules, the chief organs of sense, are very minute."

George Sarton, close to our day, mellowly proposed that Aristotle (and the fisherman from whom he gathered his accounts of Pinna and Pinna-guard) be given some credit for their ecological insights. Furthermore, he noted that early Greeks who gave the name of "pinoterés" to people who were parasites upon other people showed considerable popular knowledge of nature.

Leslie A. Stauber summarized life history information for the American oyster's form of the Pinna-guard; he referred to it as a parasite and presented evidence for that view. He also thought the species very similar to the pea crab found in Pinna's habitat. The illustrations are good. Readers may consult that work for references to literature on both European and American forms of the crab.

Aage Moeller Christensen and John J. McDermott have considerably expanded upon Stauber's study of the oyster pea crab. How different the life history of it may be from the Pinna-guard is yet to be elucidated.

With these investigations, naturally, we end the age of fable for the Pinna-guard. At least, the animals become real again (they *had* been real, however perversely, to Aristotle and Pliny). Furthermore, it is now an improvable story: when a mistake is made, another investigator can correct the viewpoint.

What about Pinna in the light of science? Gone are the days of ecclesiastical references to Pinna as producer of gorgeously colored silk that the hand of man cannot equal. What do we have instead?

For a starter, we can return to Giannettasio, and the flowery, allusive Latin of his 'Halientica' of 1689, that attempted to treat all the creatures of the sea – probably without wetting his feet. There was a

modern note: Pinna was fished up with an iron apparatus, for what purpose, I cannot make out. Maybe they were eaten. One might suppose they were being gathered for Sea-silk, but I cannot see that that was referred to there. Maybe there was simply an interest in seeing how many kinds of shells you could find, for there is much of the beachcomber in all of us. For their pearls? – maybe. For the rest, his portrait of Pinna is that of a blind creature living in abject fear of its enemies.

Antoine de Réaumur changed all that. Even without the opportunity to watch living Pinnae, he knew – it was an entirely new angle – a good deal about them. He was sometimes skeptical where he ought to have been trusting: but how could it have been otherwise? He put his thoughts – his observations and his guesses – on paper. If proved wrong, he would admit his error. Even the name sounds modern: *Pinna marina*. Like mussels, he wrote in 1711, Pinna 'is kept in a fixed spot, by a great number of fibers glued to bodies that surround it. The shell of this animal is composed of two pieces like that of mussels, but of much greater size, for one finds near the coast of Provence examples that are about one foot long, while on the coasts of Italy one encounters it as much as two feet long.'

Pinnae also differ from mussels by the fineness of their fibrous beards. Each fiber of the beard is indeed small and silky but there are many of them and the total is strong as well as exceptionally silky.

Réaumur went on: 'As I have not made observations on the coasts where Pinna lives' – what a brave, what a modern, statement! – 'I do not know how to describe the skill with which they serve themselves in forming their filaments and for the attachment of themselves to bodies that surround them. But from what we have seen in mussels [and he *had* seen that], we ought to be prepared to believe that they are produced and attached by similar mechanisms.' Since the beards of Pinna differ from those of mussels only by their length and fineness, he thought there was no doubt that whatever had been seen with mussels would be confirmed in Pinna. He kept in mind, however, the quality of Pinna's work and denominated it as deserving the title of 'the silkworm of the sea.'

In 1717, Réaumur returned to the learned world with fresh information. He still had not seen Pinnae in their natural habitat. Foundation grants were unknown in those days: but he did next best and begged from the Duke of Orleans a supply of living animals that arrived in their own sea-water. (He evidently also experimented with providing some animals with a salt solution.)

He appears to have been somewhat skeptical of the report 'by authors' that Pinnae normally lived upright on the bottom. (He was no doubt misled by his knowledge of mussels and their coarse byssal attachments to rocks in the tidal zone.) 'These stories,' he warned, 'come from fishermen; other people, whom he has come to respect, think they are always attached to rocks by their tassels of silk, because it must always be broken to remove them.' (I am not sure why he thought the stories incompatible - I suppose it is the old, old tyranny of *authority!*)

At Toulon, he reported, 'they are found in 15, 20, and 30 feet of water or sometimes more, and are taken up with an instrument called a Crampe.' He illustrated the Crampe.

Geoffroy the Younger obviously shared notes, interests and points of view with Réaumur. His account of 1712, while still emphasizing the wisdom (or lack of it) of the ancients, particularly in regard to the obscurities of the term byssus, had a good deal to say about Pinna. He recorded whatever he could learn from specimens and conversation. It was called 'Pinne marine,' 'Pinna,' 'Astura' (by Mathioli), 'Nacre' (by French fishermen of Provence). He was interested in pearls, the shell itself, the beard (up to six inches long, depending upon size of shell). He studied the silk with his microscope, mistakenly taking the fibers to be hollow (a visual artifact that is easy to understand); when he burned the silk, it smelled of urine (both aspects were faithfully repeated by later copyists). He related (no doubt, from reports made to him) that the animal Pinna lived implanted erect on the points of its shell, so had need of these silken filaments, 'which are spread out all around, like the ropes of a mast for supporting it in this position.'

Diderot's *Encyclopédie* depended heavily on Réaumur and Geoffroy. Two names were added for Pinna: 'Perna' (Naples), 'Jambonneau' (French; there seemed to be a feeling that that name might be restricted to a reddish colored form). Both words, in their respective languages, mean 'Ham.' Their pearls were thought equal to those of oysters in the Orient. The author was uncertain about reports that Pinnae were uniformly found upright in the marine substrate, for others held that they might attach themselves to a rock, in any posture they chose. Fishing for them on them on the coast of Provence took place in the months of April and May; they were accounted good to eat. Distribution and internal anatomy are recorded in detail.

Obviously, Pinna and related matters were not stinted in that great compendium of knowledge.

For all his skepticism about the Pinna-guard, the Rev. J.H. Chemnitz had no solid information about Pinna that he had not gathered from books or dried shells. His long and interesting essay, allegedly on Pinna and its silk, placed greater emphasis upon the Pinna-guard. It seems that he suspected that adult Pinnae could move about somewhat and perhaps replace their beards. Perhaps the beard was a kind of fishline for the Pinna animal.

Considering the times, Salis-Marschlins accumulated a massive amount of information on the shells of the Naples area in his travels there in 1789. His account of Pinna is long and interesting, illustrated by a plate that shows the use of an iron gadget, locally called a "pernonico," rather different from Réaumur's crampe, that was used to fish up Pinnae from the depths.

The 19th century saw few concrete new observations, aside from expansion of taxonomic accounts of species or supposed species. There appears little reason to expound on such works here.

As for the 20th century, brief accounts such as that of André Franc adequately summarize matters. Pinna was merely one among many species of mollusks; reliable new observations were few and the ancient stories were ignored.

A few technical reports have appeared. O.B. Boeggild (1930) reported briefly on shell structure in the Pinnidae. Louis Boutan (1925) and Fritz Haas (1955) described pearls, Boutan especially studying those of *Pinna*. Neither has exhausted the subject, I am sure, for there is still uncertainty whether really durable pearls are created by *Pinna*. Paul Pelseneer alluded briefly (1935) to the behavior of *Pinna*, a subject that surely deserves a whole new look in the new world of ethological investigations. Benjamin H. Grave's study of the anatomy and physiology of the wing-shell, *Atrina*, an American relative of *Pinna* is a model, the like of which would be welcome for species of *Pinna*. The illustrations are particularly good. C.M. Yonge's excellent account of *Pinna carnea*, with its sound observations on living creatures and splendid illustrations, is an example of what modern science can produce. The best general account of the Pinnidae, mostly concerned with forms of the Western Atlantic, is that of Ruth D. Turner and Joseph Rosewater. Along with many new first-hand observations, it usefully reviews literature, recent and old. It is an uncommonly good overview of a subject that might have been slighted by authors with less grasp of subject matter and narrower aims.

Systematic ecological studies, absent from *Pinna*'s past, begin to gain favor, as earnest efforts to restore populations in depleted Mediterranean habitats are being organized. Michel Highette reports on damages to populations by anchoring of boats and disturbance by divers. S. Combelles and others and Beatrice de Gaulejac and Nardo Vicente describe recent efforts to settle *Pinna* animals in *Posidonia* meadows, a preferred habitat that, unfortunately, may be beyond current dispersal powers of young mussels from their areas of origin.

And, then, there is another spate of interest in bivalve mollusks, where even *Pinna* figures, although overall rather peripherally. It amounts, in any case, to a totally new look at the fibers making up the beard or byssus by a generation of alerted biochemists.

Ivan Amato describes it well: "Stuck on mussels," for it involves a fascinating search for the biochemical and biophysical secrets of what mollusks have been doing for a good many millions of years. It seems to me that the term might be 'struck on mussels,' in the

sense of the country swain who is ga-ga over his girl; but 'stuck' thus gives the current interest away. Much of the emphasis is on natural adhesives that are formed under water (or in non-dry places, at any rate) where, after being formed and aged, they must withstand unbelievable chemical and physical attacks. (Try removing a mussel from its rock or, as many have attested, a *Pinna* from its substrate!) Interests in such glues in surgery and in every aspect of industry are endless. Clearly, of course, glue is only part of the story that must be untangled if you are to industrialize the processes accomplished by these lowly animals. Most emphasis is upon understanding byssus fiber, including its glues, but *Pinna*'s turn in other ways may some day come.

Good examples of work in this expanding field of investigations of mussel's coarse byssus fibers are K. Simkiss's work on molluscan 'skin' - including extrusions of byssus fibers; J.E. Smeathers and J.F.V. Vincent's study of mechanical properties of mussel byssus threads; and M. Cook's investigations into the composition of materials deposited by mollusks at their points of attachment.

Pinna byssus fibers get specific attention in works by Oscar Ravera, on chemical composition of *Pinna* fibers, and by F. Lucas and others on a variety of silk fibroins. *Pinna* silk is not a fibroin but a relative of collagens; its differences from silkworm silk are of interest to every curator in a textile museum when faced with a fabric of unknown (and often misidentified) material.

J. Herbert Waite, Professor of Marine Biochemistry, University of Delaware, has long been studying mollusk byssus. Because of his open interest and curiosity about all aspects of the matter of byssus formation and its history and natural history, his works will be found of great value. With, as he has written to me, a few threads to study for biochemical composition (less than one mg), a biochemist can determine the source of a fiber. Thus, spurious claims that 'byssus' is *Pinna*'s Sea-silk (or other sort of bivalve silk) can be authoritatively settled.

Notably useful papers by Professor Waite concern its nature as a quinone-tanned sclero-protein (1983); a general review of mussel

beards in the new age (1991); and, fully documented and beautifully illustrated, an analysis of the entire natural manufacturing process during which byssus fibers are formed (1992).

References

Amato, Ivan, "Stuck on mussels."

Biberg, Isac Isacson, "Oeconomia naturae," p. 48.

Boeggild, O.B., "The shell structure of the mollusks," Pinnidae, pp. 261-262 (pp. 31-32 of this part).

Boutan, Louis, *La Perle*, this essay has some new material and insights on Pinna; p. 277, claims Pinna is found at depths of 15 to 100 m.; p. 277-278, comments on geographical distribution; p. 178, describes various fishing methods, including use of the crampe; on the Atlantic coast, it appears that there are claims that they have simply been trawled in nets; on the coasts of the Provence, fishermen may take them with a running knot on a rope, a maneuver that requires great dexterity.

Brehm, Edmund, *Brehms Tierleben*, in his natural history of crabs and mussels, p. 29, Pinna-guard crab; p. 53, *Pontonia*; p. 457, Pinna, anatomy, habits, habitat, poor quality as food.

Busbecq, Ogier Ghiselin de, *The Life and Letters*, 1: 339-340.

Calman, William Thomas, *The Life of Crustacea*, p. 217, *Pinnotheres*, with illustration of pea crab; p. 218, *Pontonia*.

Chemnitz, Johann Hieronymous, "Abhandlung von der Steckmuschel und ihrer Seide, wie auch vom Pinnenwächter," a long and interesting article; pp. 1-15, an account of Pinna but much is historical; p. 12, possibility of movement in adults; p. 15, byssus as fishline; the rest of the essay concerns the myth of the Pinna-guard, which he thoroughly ridicules.

Christensen, Aage, and John J. McDermott, "Life-history and biology of the oyster crab."

Combelles, S., et al., "Contribution à la connaissance de l'écologie de *Pinna nobilis*," one finds no such densities as one hears of in the past and it is now a threatened species in French coastal waters; its association with beds of *Posidonia oceanica* is notable, considering that *Posidonia* has itself been used commercially as a fiber source.

Cook, M., "Composition of mussel and barnacle deposits at the attachment interface."

Diderot, Denis, *Encyclopédie*, 12:641-643, Pinna, the *crampe* is described on p. 642; the tufts of byssus are rarely intact; there are claims that the fibers may be up to seven or eight inches long and weigh up to 3 oz. in a single beard; the Pinna-guard is treated pp. 642-643.

Dobson's Encyclopaedia, 14: 759-760, Pinna and Pinna-guard.

Forskael, Petter (Pehr), *Descriptiones Animalium, Avium ...*, p. xxxii, number 52-56, supposed species of Pinna; p. 88 (No. 36), 94 (56), various crabs related to Pinna, etc.; p. 125 (No. 64), a form of Pinna.

Franc, André, basic account of Pinna, in Pierre-P. Grassé, *Traité de Zoologie*, 5(2): 1900.

Gaulejac, Beatrice de, and Nardo Vincente, "Écologie de *Pinna nobilis* ... côtes de Corse," p. 84, Pinna is strongly menaced in the littoral Mediterranean by abusive habitat destruction and inconsiderate activities that destroy their preferred habitat, meadows of *Posidonia oceanica*; there are not many places where juveniles can be successfully recruited and planktonic life is short; p. 88, righting and attachment of small individuals is described - test animals failed to right themselves in aquaria where water is turbulent.

Geoffroy, Claude Joseph, "Suite des observations sur les bézoards," pp. 206-207, pearls; pp. 207-208, byssus, etc.; pp. 207-208, Pinna itself; pp. 208-210, the Pinna-guard, etc.

Giannettasio, Nicolò Partenio, "Halieutica"; Thiebaut de Berneaud (1814) and Solito (1845) refer to this work, with special reference to *Polypus*, enemy of Pinna, but their references are garbled; in the version of 1689 that I have seen, there is an interesting prefatory plate, p. 178, showing what appear to be rather classically robed women with baskets of shells, perhaps mainly univalves, purpose of gathering not clear but perhaps recreational collecting; fishermen can be seen in the distance; the description of Pinna, pp. 194-195, ends with an account of the Pinna-guard; it is too bad that no English version of this can be found; I have seen only "Liber VIII."

Ginanni, Giuseppe, *Opere Postume ... Testacei Marittimi Paludose e Terrestri*, 2: 35, pl. 24, 25, 26 (called 31).

Grave, Benjamin H., "Anatomy and physiology of the wing-shell *Atrina rigida*."

Gray, Maria-Emma, *Figures of Molluscous Animals*, 5: pl. 368, 369.

Gubernatis, Conte Angelo de, *Zoological Mythology; or The Legends of Animals*.

Haas, Fritz, "Natural history of the pearls," a discussion of prismatic versus nacreous layers of pinnid pearls, p. 118.

Harting, P., "Iets over zeespinners."

Hasselquist, Fredrick, *Voyages and Travels in the Levant*, p. 239.

Hignette, Michel, "Croissance de *Pinna nobilis*."

Latrobe, Benjamin Henry, *The Virginia Journals*, 2: 503-504.

Levrault, F.G., et al., eds., *Dictionnaire des Sciences Naturelles*, 32: 157, 319-320.

Lowell, James Russell, *Literary Essays*, 1: 134.

Lucas, F., et al., "The chemical constitution of some silk fibroins."

Martini, Friedrich H.W., and J.H. Chemnitz, *Neues systematisches Conchylien-Cabinet*, 8: 208-209.

Pelseneer, Paul, *Essai d'Éthologie Zoologique d'après l'Étude des Mollusques*, p. 364, nature of byssus; p. 365, beard filaments up to 160 mm long.

Poeppig, Eduard Friedrich, *Illustrirte Naturgeschichte*, vol. 4, Pinna-guard, Figs. 2594, 2595; p. 15; Pinna, etc., Figs. 3816, 3817, 3818; p. 207; there is no mention of the commensal shrimp *Pontonia*.

Ravera, Oscar, "Ricerche sul bisso e sulla sua secrezione."

Réaumur, Antoine de, "Les differentes manieres," on different ways that marine animals have to attach themselves to rocks, gravel and one another; he refers to Pinna, p. 125, which he knew only from preserved specimens, but did not doubt that its byssus fibers were produced the same as with mussels, which he had studied; he over-generalized and doubted that Pinnas were found growing erect on the bottom of the sea, since mussels were not so restricted; his well-known name of 'silkworm of the sea' was not particularly original.

Réaumur, Antoine de, "Observations sur le coquillage," a notable early contribution to the natural history of Pinna, with details of anatomy; he reported what he had been told about its life history and how it was fished; see pp. 177, 178, 182, 183.

Salis-Marschlins, Karl Ulysses von, *Travels through Various Provinces of the Kingdom of Naples in 1789*, see especially the Appendix, pp. 435-513, "A catalogue of such shells as came to my knowledge out of the sea, that bounds the Kingdom of Naples"; throughout, there are references to his indebtedness to Father Minasi, as well as to published authorities; p. 438-439, he claims that Antonio Minasi, "a Dominican Friar of Scilla, in Calabria, ... has published several observations made by him upon fish and shells ..."; I have been unable to document this statement, for modern bibliographies leave no record of such; he goes on: "The translator and editor [Carducci] of the *Deliciae Tarentinae* [see Aquino], is, however, principally indebted to him for the notes relative to the shell fish. I have patiently perused that publication, and extracted much useful matter out of a vast mass of unprofitable erudition"; his account of Pinna, pp. 505-510, is notably full for the time, and Plate 10, opp. p. 508, gives an excellent idea of the mechanical gadget called a Pernonico that was used to fish up Pinnas from their habitats; the account of the Pinna-guard is to be found on pp. 506-507.

Sarton, George, *A History of Science*, a reference to Aristotle's notions of the Scale of Being, p. 534; for Aristotelian ecology, including the Pinna-guard, p. 565; Sarton had previously written about Pinna folklore, in his early notice of Busbecq (1941-1942).

Simkiss, K., "Molluscan skin," pp. 11-35, in Vol. 11, *The Mollusca*, ed. by E.R. Trueman and M.R. Clarke; byssus thread formation is treated p. 23.

Smeathers, J.E., and J.F.V. Vincent, "Mechanical properties of mussel byssus threads."

Stauber, Leslie A., in "Pinnotheres ostreum," believed the crab sometimes detrimental to oysters.

Stebbing, Thomas R.R., *A History of Crustacea*, the granddaddy of modern works on the Class, full of useful things; the carid shrimp, *Pontonia*, is treated pp. 241-242; *Pinnotheres*, the Pinna-guard, is treated pp. 99-101.

Thiebaut De Berneaud, Arsenne, *A Voyage to the Isle of Elba*, p. 34, oyster industry long since over-fished; p. 112, the octopus known locally as 'Muscardino' is accounted "the most formidable enemy of the Pinna marina"; he refers in a garbled footnote to Gianettassio's "Haliutica"; he

evidently did not find *Pinna* worthy of further notice.

Turner, Ruth D., and Joseph Rosewater, "The family Pinnidae," a thorough history and natural history; pp. 290-291, 292, as food; p. 292, pearls, possibly of two sorts; byssus and its history, pp. 292, 294; several of their references are explored elsewhere.

Waite, J. Herbert, "Quinone-tanned sclero-proteins," pp. 470-ff., a natural history of byssus; p. 473, physical/chemical properties.

Waite, J. Herbert, "Mussel beards: a coming of age."

Waite, J. Herbert, "The formation of mussel byssus: anatomy of a natural manufacturing process," this has been seen in a pre-print, kindly furnished by Professor Waite, to whom I am indebted for many favors.

Yonge, C.M., "Form and habit in *Pinna carnea* Gmelin," a model paper in many ways; work was done with living specimens of a common species in Bermuda; while considerably smaller than *Pinna nobilis* of the Mediterranean, all species of the genus "have the same mode of life, living vertically embedded in a soft substratum of mud or muddy sand. They are attached by exceptionally long and numerous byssus threads to stones and gravel some distance below the surface of the substratum above which project the broad posterior regions of the shell. Movement being impossible, this part of the animal is fully exposed to the danger of damage from predators or other causes." Yonge effectively shoots down any notions that adult *Pinnas* move or reestablish themselves, p. 358: "Certainly from the time when these [form and habits of the adult] are assumed the animal, if undisturbed, must remain in the same position, growing both down into the substratum and also upward into the water above."

Pinna At Taranto: Birth? Rebirth? The Nine Deaths Of The Sea-Silk Industry

Even as it explores one final aspect of *Pinna's* Sea-silk, this chapter is a retrospective look into patterns of myth-making. With some reluctance, I have come to perceive that in the history of *Pinna* we see a kind of *standardization of error*. This phrase comes to me from Vilhjalmur Stefansson: he realized that all wolves are bad because the most authoritative books tell us that this is so. In the case of *Pinna*, several errors are involved.

The matter of byssus has been dealt with. But, a phoenix from the ashes, no sooner do even experts begin to question whether all Sea-silk is byssus than we have 'Cloth of Gold' and 'Tarantine'! Surely, one's plea for proof ought to elicit a reply.

Where, really, are reports of an industry utilizing Sea-silk from, say, the year 400 to about 1700? Really substantial evidence, I mean. Well, there is the dubiously effective shade of the so-called Dark Ages that may keep us from seeing clearly. Too, Sea-silk is said to be subject to destruction by moths and other natural agencies. But ... is it more prone to destruction than woollens, silks, various plant tissues? Overall, *they* survive, plentifully. Why not Sea-silk?

True, F.G. Levrault, et al., in *Dictionnaire des Sciences Naturelles*, wrote that Sea-silk had been used since time immemorial by people around the shores of the Mediterranean. But that is the kind of irresponsible statement that we must combat. Elisa Ricci's essay on Italian peasant crafts no doubt was correct to take note of the art in 1913: but what is one to make of the claim that at Taranto people *still retain knowledge* of "the ancient and very rare art of byssus-making ... known to most people only as a commodity greatly favoured by the ancients"? "It is obtained from a certain species of shell fish, known under the Latin name of *Penna* [sic] *Nobilis*, which has the faculty of emitting a fibrous cord from its glands; this, in contact with the water, becomes exceedingly resistive, and attaching itself to the rocks serves the purpose of an anchor-line well able to stand the motion of the waves." All right, even though a fiber expert ought not to have confused *Pinna's* beard with the true byssus of "Pliny and Theophrastus." But, how can she possibly have thought: "When the fish change position they cast off their old lines and throw out fresh ones. It is these disused lines - as fine and as thin as hair - that the fisherfolk collect, clean and weave like silk"? (That they did not weave the fibers in her day we have ample proof.) "I have seen a muff and gloves made of byssus; in colour it is of a tawny golden hue, dazzling and sparkling, soft and shiny, extremely light and looking more artificial than real."

This uncritical effusion came in the era of William S. Murphy's comprehensive account of the textile industries in eight volumes, where

there is not the slightest mention of Sea-silk.

Henri Algoud, an expert on the history of silk, produced a garbled but useful account of Sea-silk in 1930. Taking advantage of uncertainties about a unitary meaning for the word 'byssus,' he compounded difficulties by claiming that Aristotle himself had sponsored the notion that Sea-silk was involved in its definition. He generalized that Sea-silk, when brought to the surface, is "of a bright green colour." He had it that when exposed to the air for some time, then passed through soapy water and finally rinsed in pure fresh water, it finally assumes "a brown colour and an incomparable golden brown brilliance." Whether the green color is indeed so uniformly found, I have not been able to determine.

Algoud very perceptively, in any case, pointed to a lack in the precision by which we are informed how workers dealt with Sea-silk. Dyeing, of course, would not be needed. He rightly ridiculed notions popularized by the myth-makers that articles made of Sea-silk instantly lost their brilliance and suppleness in contact with woollens, that odors and scents harmed them or that the use of lemon juice was a sure restorative of their youthful beauty.

From the same era came another general account that kept alive the story of Pinna but perpetuated nearly as many myths as facts. The use of Sea-silk, wrote Joyce Allan, was known back to the days of Pliny (not correct); the color was, indeed, described as "a rich golden brown colour" that, with a slight treatment, "changed to a brilliant bronze equal to that found on some beetles and flies" (implying an iridescence that it does not have). It took dyes readily (maybe: but most people valued it for its own color). One can forgive Allan for lacking a complete knowledge of Sea-silk's manufacture by Pinna. It is harder to forgive her for claiming unequivocally that "if placed back in the sea, a shell which has had its byssus removed can grow another one in its place." Without dating the industry, Taranto is made the headquarters of the industry, and the robes made there from Sea-silk were called (what else?) "Tarantine." She was at least right to note that articles were *knitted*, sometimes by mixing it with real silk. More doubtful, she had resulting articles as extremely delicate: "A pair of gloves were said to fit neatly into an empty

walnut shell and a large scarf in a snuff box." Shades of Limerick Gloves!

In accounting for the term 'Pelo di Nàccjera,' lexicographer Policarpo Petrocchi explained that it was a sort of filament that fastens onto submarine rocks the shell of some mollusks; early this century, large quantities of it were gathered on the coasts of Sardinia. He claimed no special significance for the word 'Pinna,' however: it was merely the scientific name of a marine bivalve.

Recent informants have been less certain. Riccardo Giannuzzi-Savelli writes me that at Palermo 'Lana Pinna' was used in the first half of the 1800s, with the last work in Sicily being done at Trapani; he was unable to document either statement. V. Abbate, Director of Museo Regionale 'A. Pepoli,' at Trapani has been unable to find any information on the industry there. No one he knew had heard of it or its manufacture; Dr d'Amico, a weaving expert at the museum in Palermo, was equally unaware of its use.

Cozzolino Rosalba writes that it is no longer possible to buy articles made of Lana pinna or anything dyed with 'Porpora' at Taranto. English conchologist Stella M. Turk was able to procure some items made of Sea-silk from an Italian friend in 1965, one of them having been made by nuns in Taranto; no date can be put to their manufacture and they clearly were not regularly known or available.

As a kind of aside, it needs to be emphasized that one reason for a healthy skepticism that the Sea-silk industry of recent centuries had any organic connection with that of the early Christian Era is that all examples of real or likely Sea-silk that can be reasonably dated since the Renaissance are knitted. A few specimens, as will be noted later, have fibers variously interlaced or superficially attached as a kind of matting. But ... they are not woven, as all the fine fabrics, such as Tarentines, are.

Now, the clinching argument here is that true knitting seems not to be a technique of great antiquity. If an article made of Sea-silk is truly knitted, it cannot be very old. James Yates, indeed, with perhaps a hair too much precision, held it to have been "probably

invented in Scotland. and not long before the year 1500." (It is true that C.G. Gilroy, who plagiarized Yates extensively, had it going back to the second century AD; but this seems to have been a mere misreading, where he confused Yates's date for the earliest reference to the use of Sea-silk.)

Yates cited as authority J. Beckmann, who distinguished between knitting and 'netting,' the latter a technique that is much older and much more widespread in history.

Various contributors to *Gentleman's Magazine* in 1782 argued the point of earliest reports of knitting in England but were still able to push the history of knitting back only as early as 1533; the items were cheap enough that the writer claimed that they were surely local products, so the process must have originated somewhat earlier.

The strong of heart may want to consult K. Buhler's "Basic textile techniques" for hints on the question of knitting versus other processes of making webs. A pleasanter method of acquainting yourself with the complexities of the matter is to read *A History of Hand Knitting*, by Richard Rutt, retired Bishop of Leicester. It is a wonderful story. The fact seems to be that, if you eliminate references to various knotting schemes and the like, you can find almost no datable references to true knitting before about the year 1200. Naturally, if you include any kind of knotting as knitting, as is done by American Fabrics's *Encyclopedia of Textiles* (Anon., 1972), you will push the history of the technique back many centuries.

Whatever its exact history, knitting developed rapidly, both in the complexity of its contribution to European culture and in its technical perfection. This is evident in Janet Johnson Stephens's "Knitted carpet masterpieces of the Holy Roman Empire," where an obscure technique called peg frame knitting early on resulted in knitted articles of great beauty and immense complexity; she believes there was a knitters' guild (trade union) in Paris by about 1268.

One last item is relevant because a knitting technique was used in its production: even more, the fibers used have been identified as Sea-silk. Naomi Moore has identified by study of microscopic sections

as Sea-silk, the fibers used in the knitting of a cap or bonnet found among archaeological fabrics at a site at St Denis, datable to the 14th century. The knitting was executed "en jersey avec les fils retors 'S' de deux bouts 'Z.' "

It is perhaps folly to hope to cover intelligently the history of the Sea-silk industry (with special reference to Taranto) within the confines of a chapter that must also consider other problems. Modern references to Sea-silk, almost without exception, are reducible to Taranto. If Taranto's story fails us, there is nothing elsewhere to bail us out. I think it quite unproved that the Sea-silk industry at Taranto was a continuum with the activities of the early Christian Era. As for my opponents, let me see their evidence!

A piece that W.P. Cocks quoted is pertinent: "A writer in the *Gentleman's Magazine*, in 1782 [?], says: 'The ancients had a manufacture of silk, and about forty years ago it was revived at Tarento and Regio, in the kingdom of Naples. It consists of a strong brown silk belonging to some sort of shell, of which they make caps, gloves, stockings, waistcoats, etc., warmer than the woollen stuffs and brighter than common silk.' "

James Yates, for various reasons, came to the conclusion that there was no evidence of an early manufacture utilizing Sea-silk at Taranto: he thought we had been misled because all modern references were to that area of Italy.

Perhaps as pointed, Henri Algoud wrote: "There is no record of the moment when the Italian, and especially the Calabrian [that is, in the area that included Taranto] sea-silk industry, renewed that of the marine byssus In any case, it was carried on to a fairly large extent in the XVIIIth century." He was right on target.

It is worth recalling that R. Pfister found no evidence of Sea-silk in the abundant archaeological remains in the textiles of Palmyra in Roman Syria. This was of some concern to him, as it might well have been. While I do not know what value to give his conclusions, it is clear that M.-Th. Schmitter's reference to Sea-silk in the 18th century do *not* disprove Pfister's skepticism: we are talking about a

difference in time amounting to some 1300 years, with few (or no) connecting steps between.

Guillaume Rondelet (1554) appears to have known nothing of a contemporary use of Sea-silk as 'byssus.' Similarly, a contemporary, Ogier Ghiselin de Busbecq, with his sharp eyes and, moreover, direct exposure to Pinna's in their habitat, recorded nothing about any use of Sea-silk. He did indicate an active fishery (else, why should he have been provided by fishermen with "a pole and iron contrivance made for the purpose" of pulling them up from the bottom?). Considering the disfavor with which Pinna's were treated as food (in contrast to the abundant little commensal crabs!), one wonders what the general interest was. Maybe native fishermen did, after all, eat Pinna's? Maybe Pinna's were fished for pearls or shells. Perhaps the catching device could also be used for other shells. Nicolò Partenio Giannettasio also described fishing for Pinna's without reference to any interest in Sea-silk as a source of fiber.

Arthur MacGregor's account of the Tradescants' museum (now in the Ashmolean Museum at Oxford, where it went about 1683) seems to have no reference to any fabric made of Pinna's Sea-silk. Considering the incredible hodge-podge that had accumulated in that collection over nearly a century's time, this surely means that such a fabric was not much valued, even as an article of curiosity or it was not then being made. A similar conclusion can be arrived at in regard to John Evelyn's notice of, apparently, both Pinna shell and 'Byssus Marina' in the celebrated museum of Ferrante Imperato. While 'Byssus Marina' may not be, as Evelyn's current editor thinks, the beard of Pinna, it unquestionably was not a fabric; I doubt that Evelyn would have missed such a peculiar parallel matter.

According to Giacinto Peluso, Giovanni Battista Pacichelli, head abbot at Taranto at the end of the 17th century, reported that silk was obtained from the beard by which a shell anchors itself and made into 'Beretini' the color of moss [musco] and very useful for treating discharge of the head (a variant, I presume, of the belief that 'Lana pinna' was used to treat earache, etc.; possibly, in this case, simply a warm cap); he noted that berets spun of Sea-silk cost four to five carlinis each. This, at least, gives us a firm early date for the pres-

ence of an active industry. This date also approximates the record by Filippo Buonanni (1681), who wrote that Pinna's soft beard, whose fibers were often a 'palm' in length, could be woven into fabrics that comforted the body in winter; he does not specify the place of such weaving nor indicate the magnitude of the industry.

Just when the climate changed, I do not know. By 1711, we find Antoine de Réaumur averring that 'It is most certain that people at Palermo still make fabrics and various beautiful works of the fibers that the Pinna shell furnishes.' From Réaumur's paper of 1717, it is not clear what use French fishermen at Toulon, who captured Pinna's in up to 30 or more feet of water by means of a 'crampe,' made of their catch.

It is probable that Réaumur got his information about uses of Sea-silk from his colleague, Claude Joseph Geoffroy. The latter recounted in some detail how Sea-silk was treated in his day. 'It spins coarsely,' he wrote, 'but is very much more beautiful than wool and approaches silk in beauty. Stockings are still made of it that would be very costly [or desirable] if silk were less common. For spinning this sort of byssus, one leaves it some days in the cellar, to moisten it and soften it; one then combs out dirt and other refuse that is attached to it, after which you spin it like silk.' This hardly amounts to an iron-clad guide to a novice but, clearly, it was a settled industry with settled recipes.

In a work describing a visit from Germany to Italy about 1740, Johann Georg Keyssler (1693-1743) wrote "On natural curiosities in the Kingdom of Naples": "I must not omit a particular manufacture, which is chiefly carried on at *Tarento* and *Rheggio*, where waistcoats, caps, stockings, and gloves are knit with a kind of hairy filaments growing on a species of shell-fish. In softness and fineness this stuff yields indeed to silk; but it retains a particular gloss to the last. The natural colour of these filaments is a kind of an olive-green, and the shell on which they grow is also commonly found about *Malta*, *Corsica*, and *Sardinia*: I have met with some of these shells even in the *Adriatic*, which afford but few of these useful filaments, which yield a comfortable subsistence to the industrious."

Whether a personal observation is not clear, but Antoine Joseph Dezallieres d'Argenville, as early as 1742, reported: 'In Sicily, Sardinia and Corsica, the silk of Pinnae marine is very common and serves to make fabrics, stockings and gloves. At Messina and Palermo, one sees women engaged in nothing but combing this silk that has much resemblance to the byssus of the ancients.'

With these secure references to a widespread and thriving industry before midcentury, it is strange to find Fredrick Hasselquist, having traveled by way of the Mediterranean to the Levant, report about 1752: "The tentacula, or the fibers which compose the beard of this shell fish, are as fine as silk, and seem well adapted to be woven or manufactured, if they were collected." Clearly, he knew nothing about such activities: but he probably got his information on this matter from great authorities of the past – just as he did his certainty that an octopus was Pinna's inveterate enemy and the Pinna-guard equally her constant helper.

Diderot's *Encyclopédie*, while openly skeptical that Sea-silk could ever have been abundant enough to supply fiber for all those rich trappings of David and Solomon's time, was indebted to Geoffroy the Younger in regard to the treatment. From Pinna's Sea-silk, 'people still make stockings and gloves in Sicily.'

In the account of his cabinet of curiosities of nature and art, Pedro F. Dávila (1767) noted that to one specimen of Pinna from the Mediterranean, 'someone has joined a pair of stockings and a pair of gloves of *Byssus*, that do not yield in any way to that of silk for fineness and beauty. They were made in Naples.'

Cataldanton Atensio Carducci, in his long and difficult Italian version and commentary on a Latin poem by Tommaso Niccolò Aquino, called (in Italian) *Delle Delizie Tarantine*, plumped heavily for Pinna's Sea-silk to have been the fiber of Taranto's far-famed Tarantine fabrics. I presume this notion came to Carducci from the Dominican friar Father Antonio Minasi, who was perhaps too anxious to prove diaphanous Tarentine fabrics to have been made of Sea-silk.

Carducci says that the local term *Paricèdde* (Italian *paricella*), used for Pinna, is perhaps derived from a Syrian word, *parscèll* (this is agreed to by Nicola Gigante), 'a sort of marine product of hair.' Carducci translated *Parkel*, a cognate term, as 'fruit-of-the-sea hair.'

Carducci had it this way. In ancient times, 'the dancers of the ball wore certain diaphanous clothing, called Tarantinidie [because used in the dance of that name, inspired, of course, by the myth of the dance associated with the bite of the tarantula, etc.], having the magnificence of Tarentine' [meaning the cloth of that name]. This diaphanous fabric – Carducci claimed – was made with byssus that is obtained from *Pinna nobilis*. It was a delicate and sensuous cloth well adapted to the dances where, according to what we hear from Tarantine story-tellers, women, already too much given to every kind of pleasure, were able to use clothing to show all the skin of the body. Carducci had some part of this (by way of Minasi, one supposes) from Eustazio (St Eustathius, Archbishop of Thessalonika [1130-1195]), although the word that Eustathius used was *Amorgina*, and this is not commonly thought of as Sea-silk.

Adolf Murray, in 1771, located the Sea-silk industry at Taranto. And, in an account of Taranto about the same time, Johann Hermann von Riedesel, added his observations on "a very singular" shell, the *Lana Penna*: "this shell, which is near half a palm long, is taken in great abundance near *Capo St. Vito*, the southern point of the harbour of *Tarentum*; notwithstanding its size, it gives but a small quantity of that silk of which they knit stockings, gloves, and other things, and of one pound of the raw wool or silk, only three ounces remain after it is properly prepared, and forty or fifty shells are required to give this small quantity. The fishermen sell a pound of the raw wool for 12 or 16 *Carlini*, a pair of gloves for 30, and a pair of stocking for 100 or 120 *Carlini*, or from 10 to 20 ducats: the preparation is both laborious and ingenious, only the tips of the wool can be used, and the other half is thrown away; they wash it a number of times in cold water, and dry it in the air, till it is cleared of all impurities; then they comb it on a fine wire card, and last of all spin it on small spindles, and knit it. Many mix it with silk, by which the work gets more firmness, but loses that softness and warmth which it hath naturally.

It is a matter of dispute among the *Tarentines* whether this kind of wool, or the cotton which is so universally cultivated, and of which they collect a very fine sort, called *Ventinella* (six threads of which are no thicker than one of the best common cotton) was the *Byssus* of the ancients? There is a book which treats amply on that subject, entitled *Tomasi de Vincentiis, Pinnae Tarentinae*."

It appears that everything written by M. l'Abbé Christoph Elisabeth Favart d'Herbigny, in his dictionary of the natural history of seashells (1775), was derived from Geoffroy the Younger. I cannot say whether there is anything new in a work of 1780 written by Giuseppe Capece-latro, Archbishop of Taranto, for I have been unable to examine it. It is referred to by Peluso, who tells little of its substance. It was dedicated to Catherine II, Empress of Russia. It seems likely that an article that the Archbishop commissioned to be made of Sea-silk for 'the great lady of his time' was for Catherine. Capecelatro had already paid homage to his hostess Elisa von der Reke by giving her gloves made of Sea-silk.

In his *Travels in the Two Sicilies* (1790), Henry Swinburne evidently tapped the knowledge of Father Antonio Minasi (as well as Archbishop Capecelatro) without absorbing much of it. His list of 93 species of shells found at Taranto was made up by Minasi, before the shells went into the collection of Capecelatro. He speaks of rocks in most parts of the Mare Grande being "studded with the *Pinna Marina*. This bivalved shell of the muscle tribe frequently exceeds two feet in length. It fastens itself to the stones by its hinge [!], and throws out a large tuft of silky threads, which float and play about to allure small fish: amidst these filaments is generally found, besides other insects, a small shrimp, called by the ancients *Cancer Pinnotheres*, by the modern *Tarentines Caurella*." After relating ancient thoughts in regard to the function of the *Pinna-guard*, he goes on: "but more accurate observers have discovered, that the poor shrimp is no more than a prey itself, and by no means a centinel for the muscle, which in its turn frequently falls a victim to the wiles of the *Polypus Octopodia*. In very calm weather, this rapacious pirate may be seen stealing towards the yawning shells with a pebble in his claws, which he darts so dexterously into the aperture, that the

Pinna cannot shut itself up close enough to pinch off the feelers of its antagonist, or save its flesh from his ravenous tooth."

Swinburne goes on: "The *Pinna* is torn off the rocks with hooks, and broken for the sake of its bunch of silk called *Lanapenna*, which is sold, in its rude state, for about fifteen carlini a pound, to women that wash it well with soap and fresh water. When it is perfectly cleansed of all its impurities, they dry it in the shade, straiten it with a large comb, cut off the useless root, and card the remainder; by which means they reduce a pound of coarse filaments to about three ounces of fine thread. This they knit into stockings, gloves, caps, and waistcoats; but they commonly mix a little silk with it as a strengthener. This web is of a beautiful yellow-brown, resembling the burnished gold on the back of some flies and beetles. I was told that the *Lanapenna* receives its gloss from being steeped in lemon juice, and being afterwards pressed down with a taylor's goose." All of which proves that Swinburne got his information from books and not from observation.

Giuseppe Saverio Poli, in a sumptuous account of the shells of Sicily, told of divers who brought up *Pinnas* by diving, apparently using no special equipment; he seems to have made no statement of the purpose for harvest of the shells. He accounted them edible; they were, however, rare in the market.

While he can be faulted for reporting a few things that he did not see first-hand, Karl Ulysses von Salis-Marschlins left a notably good early account of the shells of Taranto as well as of the Sea-silk industry of his day (first published 1789). As previously reported, he was greatly indebted to Antonio Minasi; his list of authorities cited is considerable – but he was "quite ignorant" of the work by Archbishop "Capece Latro." Although *Pinna* had a very wide distribution and were to be found in great abundance and often of extraordinary size, "the *Tarentines* alone reap any advantage from it, and even collect it upon the coasts of Sardinia and Corsica; but the tuft of silk, for which they are sought and collected, is not equally good in all places. Where the bottom of the sea is sandy, the shell and its tuft, which takes root in the sand, may easily be drawn out; and when washed, the tuft is of a glossy gold colour. In rushy and muddy bottoms the

shell and tuft not only stick so fast as to be generally broken when drawn up, but the colour of the silk is black, and without gloss."

Salis-Marschlins relates sympathetically the stories of the Pinna's Guard and its enemy Sepia (really, Octopus). He recounts use of the device called locally the pernonico to break Pinnas from their substrate. This was somewhat different from Réaumur's crampe, as proved by illustrations that both authors provided. (Beniamino Mastrocinque [figure 1] shows a device similar to the pernonico in use in the 20th century.)

His account of Sea-silk processing has a ring of authenticity about it and deserves careful study. When a fisherman has got a sufficient number of Pinnas, "the shell is opened, and the silk, called at Taranto *lana penna*, is cut off the animal, and after being twice washed in tepid water, once in soap and water, and twice again in tepid water, is spread upon a table, and suffered to half dry in some cool and shady place. Whilst it is yet moist, it is softly rubbed and separated with the hand, and again spread upon the table to dry; and when thoroughly dry, it is drawn through a wide comb, and afterwards through a narrow one. Both these combs are of bone, and, except in size, are like hair combs. The silk thus combed belongs to the common sort, and is called *extra dente*; but that which is destined for finer works is again drawn through iron combs, or cards, there called *scarde*. It is then spun with a distaff and spindle, two or three threads of it being mixed with one of real silk; after which they knit not only gloves, stockings, and waistcoats, but even whole garments of it. When the piece is finished, it is washed in clean water, mixed with lemon juice; after which it is gently beaten between the hands, and finally smoothed with a warm iron. The most beautiful are of a brown cinnamon and glossy gold colour, producing a very rich and pleasing effect. As every thing made of this sort of silk is very subject to be moth-eaten, care must be taken to keep it from all eatables and sweetmeats, and to wrap it in clean linen. A pair of women's gloves costs upon the spot sixteen carlini – (six shillings) – and a pair of stockings costs from three to four ducats – (from 11s.3d. to 15s.) – and so in proportion; but the sale of this manufacture is not very extensive. For my part I greatly doubt if the byssus of the

ancients were made of this sort of silk; it may indeed be true, as is supposed by the commentator upon the *Deliciae Tarentinae* [it is not clear whether he refers to Minasi or Carducci], that the glossy light garments worn by the dancing women, as they are represented in the paintings at the Museum at Portici, and which were called *Tarantinidie*, were made of this silk.

"The pinna is found most abundantly at Cape San Vito, to the east of Taranto; and the fishermen often bring from thence not only silk but beautiful pearls, and very useful mother of pearl."

Frederic Leopold, Count Stolberg, traveled in Italy and Sicily in the mid-1790s. For all his erudition, he seemed unable to tell fact from fiction. At Taranto, he visited the Archbishop (Capecelatro, I presume). "There is," he wrote, "a kind of manufacture here, which has descended from mother to daughter, probably from the times of the Greeks. A species of shell-fish, called *pinna*, the least of which are some inches and the largest may be an ell long, afford a tuft of fine hair, or threads, of polished green colour." "The Tarantines still call the fish *pinna*; but the tuft *lana pesce*: or fish wool." "The Archbishop had the goodness to send for some women, to work while we were present. The art is simple. The tufts are taken from the fish, are washed twice with soap, three times in clear water, then heckled, and afterward spun from the distaff: after which they take three threads, wind them, and out of them knit gloves, stockings, and entire garments. They have the gloss of the cloth called *drap de vigogne*, fit easily, and look handsomely. They likewise take two such threads for knitting, and add a third of silk; and the manufacture is then more durable, but less beautiful."

"These stuffs lose their gloss, and their green colour, when they are placed by the side of woollen garments. All aromatics likewise are still more injurious to them; and they are best preserved when worn with linen. After the gloss has been lost, by wear, it may be restored, by lemon juice, and water."

Count Stolberg thus agreed with Henri Algoud about the green color; his statements about deterioration and restoration appear to be without basis.

Giuseppe Vallardi profited from the popularity of tourism in Italy by writing a successful guidebook. It first appeared in Italian, of which there were some 20 editions by 1832; many French editions, beginning in 1806, followed. Many elegant maps adorn the work and the text is replete with precise milage charts. Whether noteworthy or not, he made nothing of a Pinna manufacture at Taranto, noting only the city's ancient Greek connections, its abundant fisheries and the considerable commerce in woollens. All the world, he wrote, knows of the Tarantula and the insane dancing that its bite is supposed to induce, a belief which naturalists think in great part untrue.

But at Reggio, in a voyage from Naples to Messina, Vallardi recorded: 'The inhabitants work up a great deal of silk and wool of a drab [terne] color, that they gather from the Pinne marine.' And at Palermo, he found a considerable manufactory of 'gloves of silk and the threads of Pinnes marines, of a fineness and a surprising beauty.'

Giovanni Battista Gagliardo's geography of Taranto (1811) has an account of Pinna and Sea-silk. It appears to be little different from the story told by Carducci in 1771 in his edition of Aquino.

Keppel Richard Craven's tour through the southern provinces of the Kingdom of Naples (1821) brought forth little that was new. His comment on the taste for shellfish is worth noting: "The appetite for shell-fish of all sorts, which seems peculiar to the natives of these realms, is such as to appear exaggerated to a foreigner, accustomed to consider only a few of them as eatable. This taste exists at Taranto, if possible, in a stronger degree than in any other part of the kingdom." He tells of the mussels that festoon ropes that were tied to poles stuck in the water. When the young mussels are "the size of a small bean they are plucked from the ropes, and scattered in different parts of the bay, whence, at the period of perfection, they are collected by means of iron rakes, and sent to market." Lana penna or lana pesce, he says, is a kind of silk, and "appears in a large tuft above the joint or hinge which unites the two shells [he is incorrect, of course]; this, after being cleaned, combed, carded, and spun, is finally knit into stockings or gloves, of a soft and extremely warm texture, and a beautiful glossy brown colour, enriched with a golden hue. They are reckoned excellent preservatives against cold or damp; but the small

quantity produced by each shell, and the consequent dearness of the article when manufactured, renders it more an object of luxury or curiosity than general utility."

Despite the continued comments from tourists, implying at least a thriving if low-flying industry, it seems to me that with the 1800s, the fabric had worn thin. Perhaps habitat disturbance had maimed the Pinna population. Maybe overfishing had occurred, whether in sports-fishing or for Sea-silk, meat, pearls or shells. It appears also that the formerly steady source of cheap and willing labor, especially in nunneries and orphanages, had dwindled, whatever the combination of social and economic influences involved.

Arsenne Thiébaud de Berneaud's account of a visit to the island of Elba (1814) lacks any reference to an interest in Pinna for its Sea-silk. He tells of the octopus, locally called *muscardino*, which he confuses with the Paper Nautilus, and calls it "the most formidable enemy of the Pinna marina." Perhaps his comments on oysters apply to marine shellfish in general: "Oysters ... were formerly caught off the coast of this island. This fishery has long ceased ... in consequence of the greediness of the inhabitants who have exhausted the beds, and of the anchoring of vessels along the shore." Shore erosion and great quantities of ballast thrown overboard in violation of regulations had also contributed to the devastation.

Domenico Solito left some account of the 'origin, progress and decline of the ancient city of Taranto' in his book of 1845. Aside from a fuller than usual documentation of classical authors who had written on Pinna, it repeated closely what had already become the standard account of preparation of Sea-silk. The bottom line, perhaps, was: 'The preparation of this down requires a lot of work and is of no low price.'

Carmelo Maravigna (1850) prepared a very fine-grained analysis of what he took to be numerous species of *Pinna*, using shells only, without making any reference to or illustrating the byssus.

Various general accounts summarize matters with regard to the industry: lore is mixed with standard references to Sea-silk and we

hear again and again how Sea-silk is mixed with silk, then knitted into curious articles in Taranto. See George Johnson's *Conchology* (1850); *Edinburgh Encyclopaedia*; *Brehms Tierleben* (1893) (byssus silk used for various curiosities by way of netting and knitting; southern Italy; hardly qualifies as an economic commodity); Henri Silbermann (1897) (a full account, with a good deal of history; he still had it active at Taranto and Reggio; thought annual production of fiber about 100 kg, making any article composed of it moderately costly); Otto Keller's account of the ancient animal world (1913) (Sea-silk still collected and spun at Taranto; various articles, more a curiosity than a regular commodity; but purses and gloves thus made 'are pleasing in their brown and gold-gleaming natural color and demand rather high prices').

In a guidebook to the riches of France's 'colonies' (including the Mediterranean islands), Jean Gaston Darboux and others (1906), sea-silk was mentioned, but only as something that was no longer much emphasized economically. The ancients had more appreciation for it and made it into a silken golden brown fabric called tarentine. It was claimed that as late as 1880 'there existed at Palermo an important manufacture that used this product. Even now, some people weave [sic] in Sicily and Calabria stockings and gloves of marine silk and the "Pouille" [Apulians] fabricate tarentine of it.'

In the *Larousse de XX^e Siècle* (1928, 1932), any productions of Sea-silk were novelties only, due to the rarity of Pinna. The "Pouille" make 'cloth of gold' of it, the Sicilians and Calabrians, stockings and gloves.

An account by T.V. (1988) was a retrospective look. The article was illustrated by a purse in the Musée Océanographique, Monaco, 'bought in 1910 in Sardinia at the high price of 70 francs of the time.' The author expounds on his fascination with articles woven of Sea-silk. The magic of Sea-silk is placed on a par with the wonders of the gloves and stockings that 'Bon de Saint-Hilaire was able to weave at Montpellier, at the beginning of the 18th century, with the silk of spiders, of which the kilo was valued at 2000 gold francs.' (For a modern account of spider silk, see Randolph V. Lewis's essay.) It is claimed that 'weavings' (perhaps the word merely means fabrica-

tions) were made in France of 'poil de nacre' and of 'ablaque' (local names for Pinna) and exhibited in the Paris expositions of 1806 and later.' It is alleged that dealers paid up to 300 francs the ounce, for such articles but it is not clear to me what exchange rate one is to apply to a franc.

But this does not address adequately the agonies of the Sea-silk industry at Taranto (and, of course, elsewhere in the Mediterranean, although the latter is not so well documented). Carlo Piersanti's rather rare conchology (1926) makes the Sea-silk industry originate anciently, as if all of a piece; he refers to efforts by Marino Conti of Galatone, who developed techniques of treatment of Sea-silk to produce an exquisite fabric – but his death ended the venture. I cannot find anything about Marino Conti, although his efforts are mentioned also by Pietro Parenzen (1960); in neither case is the period of his activity clear.

By far the best history of those efforts at revival of the trade is to be found in a recent essay by Giacinto Peluso (1993). His list of authorities is impressive and some of them have so far proved difficult or impossible to find in American/English bibliographies and I cite them only from his work.

Peluso alludes to 'one of the more substantial – and costly – efforts' to resuscitate the industry, undertaken by Domenico Sebastio, Baron of Santa Croce (or Santacroce) in the latter part of last century. That noble native of Naples was of Tarentine ancestry. He was a suicide in 1882 at a sanatorium in Naples. On the occasion of a visit to our city [Taranto] by HRH the Duke of Aosta, the Baron (says Narciso Bino) "at his own expense chartered ten boats completely equipped for fishing the *paricelle* from which would be extracted the byssus that would restore fame to Taranto and, as well, an industry that was on its way to extinction." The Duchess of Aosta, of Spanish birth, impressed by the beauty of the textiles, attempted to promote its sale among Spanish merchants.

A survivor of one of those boat crews (there is disagreement whether a crew was ten or twenty men), one Nunzio de Giorgio, was interviewed by Beniamino Mastrocinque in 1927. De Giorgio recalled that

they got (that is, his crew got – or was it the entire fleet?) ‘daily the byssus required for the manufacture of a shawl.’

Mastrocinque recorded the fact that a shawl made by the nunnery [monache] of Santa Chiara was given by the citizens of Taranto to the Princess of Cisterna, who was associated with Amadeo di Savoia’s brief occupation of the throne of Spain. Its effect in reviving the flagging industry was equally null.

In 1886, wrote Mastrocinque, ‘the Archbishop of Taranto, Pietro Alfonso Jorio, on the occasion of the priestly jubilee, offered to the Pontiff Leo XIII a grand carpet [tapestry?] made of byssus, the center showing the Papal coat of arms. Put on show in the Vatican Exposition of that year, the valuable work attracted the attention of all scholarly visitors and the admiration of all ...’ but it was without effect in reviving the industry.

Further: hoping similarly that gifts of items made of Sea-silk would encourage the great and famous to sponsor its revival, there were presented ‘to the Hero of the Two Worlds’ [Garibaldi], after the battle of Aspromonte, a beret, a pair of gloves and a pair of stockings. Also Queen Margherita (1851-1926) was given a costly mantle made of Sea-silk from Taranto.

Giuseppe Basso-Arnoux (1916) tried to promote government sponsorship for reviving the Sea-silk industry. He devised and illustrated precise and elegant equipment for efficient collecting of fibers, cleaning and combing them and spinning them into threads. His efforts deserve more space than I can give. No doubt, part of the reason for his failure was the disastrous occurrence of World War I.

Beniamino Mastrocinque’s efforts a decade later – on the doorstep of the Great Depression – to resuscitate the Sea-silk and the marine purple industries at Taranto were recounted in detail in his rare publication, illustrated with handsome color plates, in 1928. His final reaction was one of bitterness at his failure, as Peluso notes. Clearly, he blamed it on a lack of the ancient spirit of the city, not (perhaps more realistically) on the depleted beds of Pinna and the requirement that an occupation repay the efforts of craftsmen.

Peluso puts it well: ‘At the beginning of our century, the working of byssus was only a memory for most of our population. Only the industrious nuns of two convents (San Giovanni and Santa Chiara) continued to work in the material, along with a few surviving members of old Tarentine families.’

Peluso recounts the lively interest in reviving the Sea-silk industry in the decade 1914-1924 by the philanthropist and archeologist Count Zanotti Bianco (1889-1963). It was not crowned with success. Participants in the 31st meeting of the Dante Alighieri Society, held in Taranto in 1926, were duly exposed to the thought of reviving the industry, but without success. Nor, concludes Peluso, did the alluring propositions put forth in 1927 by Professor Lino Vaccari, Central Inspector of the Ministry of Public Instruction (formerly teaching professor at the University of Firenze), help.

Myriam Riccio (1932) comments on some efforts of the 20th century to bring the industry back in Sardinia.

In 1937, Rita del Bene made a vigorous pitch for redevelopment of the Sea-silk industry, as one contribution to economic independence of Great Italy (it was Year XV of the New Order). Her account was mostly wishful thinking but reported such facts as she had in hand, for she had obviously worked seriously with the material herself. It was, she thought, a matter of rejuvenating pinniculture, still in its infancy. She felt that crude byssus was worth about 12 to 15 liras per kg – from which she was able to derive a yield of 600 to 700 grams of refined fibers.

Thought was being given to rejuvenating Pinna beds in Bene’s time, as a step toward renewing the Sea-silk industry. This was shown by Attilio Cerruti’s hopeful report on experimental reestablishment of Pinnas at Taranto in 1938.

It may be that a few of the examples of fabrications of Sea-silk mentioned in Peluso’s important paper can be traced. He mentioned particularly an event described by Giuseppe Blandamura in his work on Taranto in history and art, which I have been unable to see. Tapestries of great magnificence were hung on the wall of the cathe-

dral in Taranto on the visit of Archbishop Lelio Brancaccio in 1576. Parts of these seemed to Peluso as likely to have incorporated Sea-silk. Whether there may be some confusion over 'Cloth of Gold,' 'Tarentine' and Sea-silk, I cannot say.

The collection of Friedrich von Martini contained a pair of stockings. Various sources have reported the gift of a pair of stockings (or was it gloves?) to Pope Benedict XIV in 1745 (or was it 1754?) (*Dobson's Encyclopaedia*; W.P. Cocks; Marco Suraci). Marco Suraci also reported the gift of a pair of stockings made of Sea-silk at Taranto to Queen Victoria (of England? – it is possible that Maria Vittoria, wife of King Amedeo of Spain, was meant).

As early as 1778, collections of the British Museum claimed a pair of elegantly cuffed gloves from Andalusia, Spain, illustrated in J. & A. Rymsdyk's *Museum Britannicum* (Sloane 4912; these gloves are identified in this book as men's, having been donated by the late – how late is not said – Duke of Richmond). Another pair of gloves (short-cuffed) at the British Museum is illustrated by Peter Whitehead and Colin Keates. There may be some mistake here, for Richard Rutt, authority on hand-knitting, examined the items in 1992 and reported as follows: a woman's glove, one only, Sloane 4912. It is knitted in stockinet: "Two rows of reversed stockinet with knitted fringe at the cuff, the same decorative work round the wrist. 6.5 stitches to 10mm." Bishop Rutt treats the pair of gloves as men's, "Knitted in a plain design at 7 stitches to 10mm." He lists another glove, also accounted a woman's glove, with a long pointed cuff, labeled *Pinna squamosa* (a name coined by Gmelin in 1791 = *P. nobilis*), labeled Sloane 5711. (Sloane items 24/4912 and 24/5711 are referred to in Kathie Way's account of Sloane's invertebrates in Arthur MacGregor's biography.) The British Museum's Department of Invertebrates, where the items are kept, has other *Pinna*-related items: a specimen of *Byssus* from *Pinna nobilis* (from the Mediterranean 70.6.26; 100mm long; "unspun fibers handsewn on fabric as a shaggy mat (approx 600 x 400mm?) Gift 1979-80, from Taranto"; a "small fragment of twill-woven fabric with felt backing." (Rutt notes: "In the knitted items increases are made [for example, at the thumb gore] by working into the bar between two loops.") It is no-

table that Mastrocinque's interesting work has a color plate (between his pages 4 and 5) of just such a fabrication as that described above as "unspun fibers handsewn on fabric as a shaggy mat."

The Field (sometime Chicago) Museum of Natural History has three items, now in the Department of Invertebrates, acquired by the Ward Natural Science Establishment for the Columbian Exposition of 1893. There seems no reason to doubt their authenticity; they are a glove (like the short-cuffed ones at the British Museum) and a cap, both given the accession number of 2461. (These have been photographed by me.) They also have a muff, No. 2462, in such weakened condition that it cannot be circulated.

The Leiden Museum of Natural History has a pair of gloves, with no information on provenance, etc.

The Musée Océanographique, Monaco, whose directors have long been interested in items related to *Pinna* and Sea-silk, has, in addition to examples of shells and entire byssus tufts of *Pinna*, the following: a small purse (97 1312-1); a cap (97 1312-2); a tuft with cord, etc. (97 1312-3); an arrangement of tufts and ornamental stone (97 1312-4); six tufts with cords (97 1312-5); a tuft with cord (97 1312-6); tufts of washed Sea-silk (97 0667-6).

The U.S. National Museum of Natural History has a glove from Taranto, knitted of Sea-silk (No. 149395), illustrated by Turner and Rosewater. I have been unable to learn anything more about it.

C.J.S. Thompson's guide to specimens in the historical series in the Hunterian Museum, Royal College of Surgeons, London, listed "a specimen of *Byssus* of *pinna nobilis*, a horny secretion from a gland in the foot ..., with a pair of gloves and objects woven from it, and spider's silk woven into ribbon." All were lost in the bombing of London and no photographs or other records are extant.

W.P. Cocks reported that the Great Exhibition in London in 1851 exhibited products made of *Pinna* silk but I have no details.

P.L. Simmonds reported that items made of Sea-silk were exhibited at the International Exhibition in London in 1862. See also M.S.

Lovell. This is confirmed by the catalogue of the exhibition ("Dessi Magnetti Avv. V. Cagliari. - Byssus of the Pinna, with thread, gloves, etc., made of it") and by the fact that the Royal Scottish Museum, Edinburgh, now has the items just named. These were presented by the Royal Italian Commission of that exhibition to the old Industrial Museum of Scotland. Today, they are identified as Pinna byssus; Pinna byssus woven (that is spun) as thread; and "Scarf and gloves of byssus." The scarf is described as a long, narrow net by curator David Heppell, the only thing of its kind that he has ever seen. I presume this is what Simmonds called "thread, cravat, and gloves" that were exhibited by V. Dessi Magnetti.

J.G. Jeffreys, in his account of British shells refers to "our last International Exhibition" (which I take to mean that of 1862 and not the exhibition of 1851), where, he claimed, "a Cornish muff made of this material [Sea-silk, presumably gathered from the English species, *Pinna rudis*] might have been seen by those who were disposed to venture into an obscure gallery in search of the few objects of natural history for which any space was allotted." I am unable to confirm this; but, if true, it is the only reference to such use of Sea-silk of British origin of which I have heard.

Luigi G. de Simone, according to Giacinto Peluso, referred to items of Sea-silk made at Taranto that were shown in the Universal Exhibition at Paris in 1867. P.L. Simmonds reports the items to have been shawls made of Sea-silk, shown by "Paul Montego, of Asti, Alessandria." However, the *Official Catalogue* gives the exhibitor's name as P. Montara of Alexandria, "Shawls of Pinnemarine [sic] hair (*Pinna mobilis* [sic])."

References

Abbate, V., letter 25 Se 1993.

Algoud, Henri, "Byssus et soie de mer."

Allan, Joyce, "Silk from shells: an ancient industry."

Anon., 1782, Letters in regard to early instances of knitting in England, *Gentleman's Mag.*, 52: 229; see also p. 76.

Anon., 1782 [sic]; see *Gentleman's Mag.*

Anon., 1972, *AF Encyclopedia of Textiles*, pp. 349-350.

Aquino, Tommaso Niccolò d' (1665-1721) *Delle Delizie Tarantine*; Peluso quotes at length from this work, with special reference to pp. 260-262, which contain the material on this subject that he cites; there is a full historical accounting of marine-purple, another notable Tarentine product from the sea, pp. 223-236.

Basso-Arnoux, Giuseppe, "Sulla pesca ed utilizzazione della 'Pinna nobilis' e del relativo bisso," a full account of a modern attempt to revive the Sea-silk industry, complete with details of new equipment and techniques; I have not been able to find an article on Pinna byssus by him, said to have appeared in 1908 in *Bolletino Chimico-Farmaceutico* (Società Farmaceutica, Milano).

Beck, S. William, *The Draper's Dictionary*, a useful compendium of terms in the textile industry; 'Byssus' is treated pp. 39-40, where a great deal of history is drawn in and indiscriminately intermixed with natural history.

Beckmann, John, *History of Inventions*, 4th ed.. "Knitting." 2: 355-376.

Bene, Rita del, "Tessuti di bissi / Lana-pinna o Lana-pecce," a rather optimistic plan for renewing the industry, with details of new techniques.

Bezon, Jean, *Dictionnaire Général des Tissus Anciens et Modernes*, "Byssus" and "Pinnes marines," 1: xlvi-xlix; he thoroughly mixes history with zoology and seems somewhat nonplussed at the lack of conformity.

Bino, Narciso, *Lire Funeste*; I have not seen this but Peluso says that there is on p. 58 an account of efforts by Domenico Sebastio in the late 1800s to reestablish the industry at Taranto.

Blandamura, Giuseppe, *Il Duomo di Taranto nella Storia e nell'Arte*, on p. 137, he reports on visit to Taranto of Archbishop Lelio Brancaccio in 1576 (per Peluso; I have not been able to trace this work said to have appeared in 1923).

Blandamura, Giuseppe, *Choerades Insulae (Le Cheradi del Jonio)*, with reference to Sea-silk industry at Taranto, pp. 43-44, which he claims goes back to its production of the luxurious cloth called 'Tarantinidie' (per Peluso; work not seen by me).

Brehm, Edmund, *Brehms Tierleben*, Bd. 10: 457.

Bühler, Kristin, "Basic textile techniques," knitting, pp. 2292, 2296-98, 2300-2301, illust., p. 2304.

Buonanni, Filippo, *Ricreatione dell'Occhio e della Mente*, p. 156; a thorough search of Father Buonanni's abundant writings may reveal further hints on the weaving and characteristics of the fabric.

Busbecq, Ogier Ghiselin de, *The Life and Letters*; his account of Pinna fishing, etc., is 1: 339-340.

Capecelatro, Giuseppe, Archbishop, a noted patron of the natural history of mollusks; he appears to have written at least two works on shells, neither of which has come to my hand; in fact, I cannot find any notice of *Spiegazione della Conchiglie che si Troano nel Piccolo Mare di Taranto* (1780), said by Peluso to have been reprinted by Luigi Sada (q.v.); the other work, *Memoria su i Testacei di Taranto Classificatati Secondo il Sistema del Ch. Linneo*, although vaguely known, has eluded me; the Baronin Elisa (Elisabeth Charlotte Constantia) von der Recke (1754-1833), says Peluso, translated some part of Capecelatro's Pinna work but I have not been able to identify it in lists of her works.

Cerruti, Attilio, "Primi esperimenti di allevamento della Pinna."

Cocks, W.P., "Addenda to Falmouth fauna," pp. 21-22, under *Pinna ingens* Mont.

Conti, Marino, of Galatone; said by Parenzen and Piersanti to have been unsuccessful in efforts to reestablish the Pinna industry; neither gives him dates, etc., and I have not been able to find anything about him.

Craven, Keppel Richard, *A Tour through the Southern Provinces of the Kingdom of Naples*, p. 188, probably first hand but he rather repeats previous authors.

Darboux, Jean Gaston, et al., "Nos richesses coloniales ... l'industrie des peches aux colonies," 1: 122, "Soie marine."

Dávila, Pedro F., *Catalogue Systématique*, 1: 389, an example of a pinne-marine from the Mediterranean has accompanying it a pair of stockings and a pair of gloves.

Dezallieres D'Argenville, Antoine Joseph, *L'Histoire Naturelle Éclaircie dans Deux Parties Principales*, 2: 183.

Diderot, Denis, *Encyclopédie*, the account of Byssus, 2: 471-472, is heavily indebted to Geoffroy the Younger, with additions from other sources; some notice of Sea-silk also occurs under Pinne-marine, 12: 641-643.

Dobson's Encyclopaedia, "Pinna," 14: 759-760.

Edinburgh Encyclopaedia, "Byssus," 12: 372.

Eustathius, Saint, Archbishop of Thessalonika (1130-1195), his works, in Greek/Latin only, ed. of 1688, line 525; his reference is to *amorgina*, which is not Sea-silk, whatever Carducci says in Aquino, pp. 261-262.

Evelyn, John, *Diary*, 2: 330-331.

Favart d'Herbigny, Christoph Elisabeth, M. l'Abbe, *Dictionnaire d'Histoire Naturelle*, "Byssus," 1: 154-155, an account that owes much to Réaumur and Geoffroy.

Field Museum of Natural History, Chicago, three articles of Sea-silk described, letter of Margaret Baker, Curator, Division of Invertebrates, 22 Oc 1993; I have examined the cap and glove; while beautiful examples of knitting, neither in any way qualifies as a diaphanous fabric.

Fonseca, C.D. (Cosimo Daminano?), *Puglia Ieri; il Regno de Napoli in Prospettiva dell'Abate Gio. Battista Pacichelli*, a work published at Bari, cited without date by Peluso; I have been unable to find it.

Gagliardo, Giovanni Battista, *Descrizione Topografica di Taranto*, pp. 76-78, an account of 1811 that owed much to Carducci's edition of Aquino.

Gentleman's Magazine; a most interesting puzzle; this comes from Cocks, 1862: 22 and is repeated by Turk, 1982. It was claimed that the account appeared in 1782 but there must be some mistake; I think the article authentic, so the date must somehow have been scrambled.

Geoffroy, Claude Joseph, "Suite des observations sur les bézoards," pp. 207-208; this is an early notice of the lack of fineness in Sea-silk.

Giannettasio, Nicolò Partenio, "Halieutica," a poetic commentary on sea-shore life in the Taranto region, etc., in high-powered Latin verse; fishing for Pinna is described but there appears to be no indication that its Sea-silk was used to make a fabric; an interesting plate at the beginning of the chapter shows classically draped figures in the foreground, with baskets of mollusks, perhaps shells merely, maybe oysters and the like; a figure in the middle background wears a simple short-peaked cap remarkably like the

one of Sea-silk in the Field Museum collection.

Giannuzzi-Savelli, Riccardo, of Palermo, letter 8 Au 1993; thinks lana pinna was used in Sicily first half of the 1800s, with last work there being done in Trapani.

Gigante, Nicola, *Dizionario Critico Etimologico del Dialecto Tarantino*, p. 358, *Paricèdde*, a bivalve shell called in Latin *perna*; *Parnuètacha*, name of the device used for fishing for Pinna, apparently derived from the word *perno*, etc., meaning 'ham.'

Hasselquist, Fredrick, *Voyages and Travels in the Levant*, p. 239; it is difficult to account for his failure to realize that there was already a thriving industry in Sea-silk.

Jeffreys, John G., *British Conchology*, 2: 101; calling it the 'fan-mussel,' describes *Pinna rudis*, given the name "feaskand" in Gaelic; says that, though "stiff and wiry" when dried, the byssus if collected and cleaned when fresh, became "sufficiently flexible to be woven into gloves and stockings"; a sober and useful account.

Johnston, George, *An Introduction to Conchology*, pp. 68-69.

Keller, Otto, *Die Antike Tierwelt*, 2: 489.

Keyssler, Johann Georg, *Travels through Germany ...*, 2: 350, in a chapter "On natural curiosities in the Kingdom of Naples"; the first German edition of this work appeared in 1740 and I have no doubt that this approximates the date of his observations.

Larousse De XX^e Siècle, 1: 923, items made of 'byssus' only a curiosity due to rarity of the jambonneaux.

Leiden Museum of Natural History, letter 1991.

Levrault, F.G., et al., eds., *Dictionnaire des Sciences Naturelles*, 32: 157.

Lewis, Randolph V., "Spider silk."

London, *The Great Exhibition*, 1851; cited by Cocks, 1861: 22.

London, *The International Exhibition*, 1862, 4, unpagged, under Classes XXVII and XXVIII – Italy, Sub-Class C, No. 1666; see Royal Scottish Musum.

Lovell, M.S., *The Edible Mollusks of Great Britain and Ireland*; his extended account of Pinna, the Sea-wing, occupies pp. 139-143; reference to articles made of Sea-silk at the "International Exhibition," presumably London, 1862, p. 142; his recipes, pp. 142-143, give it a better repute than most commentators ("nearly as good as the scallop").

MacGregor, Arthur, ed., *Sir Hans Sloane* see Kathie Way; Dr MacGregor kindly supplied news of this publication.

MacGregor, Arthur, *Tradescant's Rarities*.

Maravigno, Carmelo, "Monografia delle specie del genere Pinna di Linneo," taxonomic only and, at that, based entirely on shell externalities.

Martini, Friedrich H.W., and J.H. Chemnitz, *Neues systematisches Conchylien-Cabinet*, 8: 209.

Mastrocinque, Beniamino, *Bisso e Porpora*, a rare, beautifully illustrated booklet dedicated to the renewal of the ancient Tarentine industries of Sea-silk and marine purple; extensively quoted by Peluso but still worthy of study throughout; I am indebted to Cozzolino Rosalba, Biblioteca Civica "P. Acclivie," Taranto, for a photocopy, including color photographs of plates, and to Dr Costanzo Casucci, Biblioteca Giustino Fortunato, Rome, for clarification of pagination. His account of Pinna occupies pp. 5-40.

Monaco, Musée Océanographique; a great deal of information has been supplied by Dr C. Carpine, curator of collections.

Moore, Naomi, unpublished account of archeological Sea-silk, a knitted cap from 14th century France, to be published by the Unité Archeologique de St. Denis; confirmation was by microscopic study of cross-sections of fibers; I am indebted to P.W. Rogers for first telling me of this important discovery; see also letter from N. Moore, 31 Oc 1991.

Murphy, William S., *The Textile Industries*.

Murray, Adolf, *Fundamenta Testaceologiae*, p. 114, on the use of Sea-silk at Taranto; an academic thesis commonly attributed to Linnaeus; the latter's propensity for using anatomical terms of dubious social currency in naming parts of mollusks is well exemplified – in dignified and scholarly Latin.

Nouveau Larousse, *Nouveau Larousse Illustraté*, 1(1): 20, the otherwise mysterious term "Ablaque," 'the common [vulgaire] name of a silk or byssus possessed by certain bivalve mollusks.'

Pacichelli, Giovanni Battista, *Il Regno di Napoli ... Opera Postuma*; referred to by Peluso; reproduced by C.D. Fonseca; not seen by me.

Parenzan, Pietro, *Il Mar Piccolo di Taranto*, an important modern notice of Pinna and the Sea-silk industry, as well as of Marine-purple, with an abundance of historical allusions; it is much in the vein of Peluso's work, where it is cited several times; the Pinna account is found pp. 205-211.

Paris, Universal Exhibition 1867, *Complete Official Catalogue*, p. 57; the egregious errors may not occur in the French edition.

Peluso, Giacinto, "L'Industria Tarantina del bisso fra tradizione e storiografia," a most important paper that cites several works so far unavailable to me; "the hero of the Battle of Aspromonte" I have guessed to be Garibaldi, although who was a hero might depend upon which side you were on – Garibaldi was captured and (briefly) imprisoned by the central government; Amadeo di Savoia was Amadeo, King of Spain 1870-1873; his queen was Maria Vittoria dal Pozzo della Cisterna, who is perhaps the "Queen Victoria" who was credited by Suraci with receipt of items made of Sea-silk; "Archita" (= Archytas) (fl. 400-350 BC), referred to as characteristically wearing a headdress made of a material accounted to be Sea-silk, on the perhaps dubious authority of Aquino's commentators, was a widely respected Tarantine contemporary of Plato; it may be worth noting that I can find nothing on Domenico Sebastio, Baron of Santacroce; I have noted Peluso's use of material from Narciso Bino and Giuseppe Blandamura (1923, 1925).

Petròcchi, Policarpo, *Novo Dizionario Universale della Lingua Italiana* 2: 316. under "Nàcchera" and "Pelo di Nàcchera," with special reference to the collection of Sea-silk in Sardinia.

Pfister, R., *Textiles de Palmyre*, 1: 34; see Schmitter.

Pierpoint, Robert, et al., "Limerick gloves in a nutshell," etc., series 11, 2: 249, 297: "In Mrs. Gaskell's 'Ruth,' chap. xx., we read: – 'She went upstairs and brought down a delicate pair of Limerick gloves, which had been long treasured up in a walnut shell. 'They say them gloves is made of chicken's-skins,' said Sally, examining them curiously. 'I wonder how they set about skinning 'em.' ' '"; well, they were not made of Sea-silk!

Piersanti, Carlo, *I Molluschi e le Conchiglie*, a peculiarly obscure work bibliographically; Chris Lammens kindly furnished a copy of title page and pp. 132-133; Piersanti accounted Sea-silk more a novelty than a serious fiber source, although he credited Marino Conti of Galatone with succeeding in making textiles of exquisite fineness from it; I have not found out anything

about Conti.

Poli, Giuseppe Saverio, *Testacea vtrivsqve Siciliae eorvmqve et anatome*, a now rare work that, although available in microfilm, I have been unable to see; see vol. 2 (1795), pp. 238-248, plates 36-39; James Yates, pp. 153-154, quotes and translates into English an extended account of diving for Pinnas – diving, unassisted by gadgets, was obviously the usual method of fishing known to Poli; Lovell, pp. 142-143 cites Poli on edibility, etc.

Réaumur, Antoine de, "Les differentes manieres ...," p. 126, reported a contemporary (1711) Sea-silk industry at Palermo; an important early reference with a beginning of true observation of nature.

Réaumur, Antoine de, "Observations sur le coquillage ...," comes a little closer to real observations on Pinna but his claim that people were "still" using Sea-silk is not further documented.

Recke; Baronin Elisa von der, I have been unable to confirm Peluso's reference to a translation by her of a monograph on shells by Archbishop Capececiatro.

Ricci, Elisa, "Peasant crafts in Italy," a naive account of Sea-silk and its processing at Taranto.

Riccio, Myriam, "Il bisso del mare di Sardegna," a Sunday-supplement article (1932); there seemed some hope of restoring the industry.

Riedesel, Johann Hermann von, *Travels through Sicily and ... Magna Graecia*, pp. 178-179; I have been unable to identify his reference to a work, negative in regard to whether Sea-silk was the byssus of the ancients; this work is referred to as "Tomasi de Vincentiis, Pinnae Tarentinae"; it seems to have considered that the ancient byssus was the equivalent of modern "Ventinella," a variety of cotton – from my readings, I should have taken the ancient Tarentine cloth of greatest repute to be woollen; perhaps the question of a special cotton needs to be considered more seriously?

Rondelet, Guillaume, *Libri de Piscibus Marinis*, vol.1, Pinna, pp. 50-52, Byssus, pp. 54-55.

Rosalba, Cozzolino, Biblioteca Comunale, Taranto, letter, Sept. 1993.

Royal College of Surgeons, Hunterian Museum, London; specimens lost in bombing raids; letter of E. Allen, 14 Ap 1993; no photographs or records have survived.

Royal Scottish Museum, Edinburgh, *Catalogue of Industrial Department*, p. 36; David Heppell, curator, has been helpful in supplying information on specimens.

Rutt, Richard, *A History of Hand Knitting*; a storehouse of information, most interestingly presented; there is an account of peg frame knitting – quite obviously not a simple matter! – on page 22; Bishop Rutt was kind enough to reply to my queries and to examine articles, mostly knitted, in the British Museum.

Rymsdyk, J., and A. Rymsdyk, *Museum Britannicum*, p. 34, plate XII; an account of Pinna, with illustration of both a valve of the shell and a tuft of byssus silk and what is said to be a pair gloves, closely superposed one on the other, identified here as men's, although quite ornate and perhaps more properly considered a woman's glove (now present as a single glove) by Richard Rutt who examined it in the current collection of the British Museum (Natural History); it appears that this work has appeared in large and small format; in the great edition, the text account of Plate XII is to be found on pp. 281-282.

Sada, Luigi, *Perle dei Mari di Puglia*; said by Peluso to reprint Capecelatro's work on the conchology of the Mari Piccolo; I have been unable to trace it.

Salis-Marschlins, Karl Ulysses von, *Travels through Various Provinces of the Kingdom of Naples in 1789*; a lively interest in shells and their history and natural history, with notable accounts of the shell producing marine-purple, Pinna and Sea-silk and much else in his substantial appendix, "A catalogue of such shells as came to my knowledge out of the sea, that bounds the Kingdom of Naples," pp. 435-513; his plate X, opp. p. 508, shows well the device used for fishing for Pinna; it is different from Réaumur's 'crampe' but seems to be the one described a hundred years before by Giannettasio.

Schmitter, M.-Th., "Subsericae vestes," his argument, p. 215, that the modern Sea-silk industry at Taranto disproves Pfister's conclusions, cannot be sustained.

Silbermann, Henri, *Die Seide*, 1:72, a reference to "Agremontin" in Sicily, which he inclined to equate with Sea-silk; his general account of "Muschel-seide," pp. 337-338, is full and useful, even though it provides some wild goose chases as well.

Simmonds, Peter Lund, *The Commercial Products of the Sea*, a substantial account of "Marine Silk," pp. 306-310; while a rather naive summary, it attempts to include factual material; he credited a considerable manufactory

to Palermo, where quite elegant fabrics were produced; the best materials were said to come from the Orphan Hospital of St. Philomel at Lucca.

Simone (or De Simone?), Luigi G. de, *La Madreperla Salentina ed il suo Bioccolo*; Peluso reports that this work had some reference to materials made at Taranto of Sea-silk, shown at the Paris Exhibition of 1867; I gather it must have been meant as an amusing skit if I translate the title correctly; I do not find the work cited in American bibliographies.

Solito, Domenico, *Descrizione Storico-Filosofica*; while this work of 1845, replete with classical references, is generally ignored in American, English and French bibliographies, there is a copy at the American Museum of Natural History and Engelmann, p. 466, gives pretty full information; Dr Fernando Ghissoti (letter 25 Oc 1991) supplied copy of title page and the account of Sea-silk, and translated a part of the latter; Parenzan, p. 252, mentions what seems to have been a precursor of the work that appeared in the *Accademia Gioenia di Scienze Naturali*, Catania (1843), but I have been unable to trace it.

Stephens, Janet Johnson, "Knitted carpet masterpieces of the Holy Roman Empire."

Stolberg, Count Frederic Leopold, *Travels ... Italy, and Sicily*, 2: 151-152; although he had the opportunity for personal observation, he repeated much from hear-say or the literature; he had, at any rate, seen women at work with Sea-silk; his claim that at first Pinna's byssus is of a "polished green colour" may owe something to the English translator, but Algood likewise mentions a green coloration; Professor Waite tells me that he has noted "a green iridescence in the proximal portions of byssus fibers in freshly collected *Atrina*," and accounts it attributable to organo-metallic complexes rather than to an algal growth; that Stolberg's Sea-silk lost its green color when placed with woollen garments seems a wild shot.

Suraci, Marco, "Le conchiglie produttrici della preziosa 'Lana penna,'" this article appeared in March 1986, p. 94, in a periodical identified for me only as *C & S*, which I assume may be *Cultura e Scuola*, but the periodical is unavailable.

Swinburne, Henry, *Travels in the Two Sicilies, 1777-1780*, a map/view of Taranto, and, 2: 75-76, a list of shells of Taranto from Father Minasi; much hear-say, some of it fabulous; while it was silly to assume that the beard of Pinna – thought to be on the hinge side of the animal! – was a lure for small fishes, he did notice that Sea-silk was only knitted into finished products and that Sea-silk was often mixed with other fibers; 1: xv, his

indebtedness to Father Minasi and Archbishop Capeceletro; his account of Pinna is 2: 77-79.

Thiébaud De Berneaud, Arsenne, *Travels ... Elba*, his notice of Pinna contains no reference to Sea-silk productions; p. 34, the depletion of oyster beds; p. 112-113, a brief account of Pinna.

Thompson, C.J.S., *Guide to the Surgical Instruments and Objects in the Historical Series*, p. 75, account of the specimen of "Byssus of pinna nobilis ... with a pair of gloves and objects woven from it."

Tomasi De Vincentiis (or similar spelling), something on *Pinnae Tarentinae*, mentioned by Riedesel, g.v., as doubting that Pinna Sea-silk and the ancient Byssus were the same; I have been unable to trace it.

Tradescant, John, the Younger, *Musaeum Tradescantianum* (1656), p. 13, a specimen of shell and of Byssus tuft of Pinna; no record of fabric made of Sea-silk.

Turk, Stella M., "The silk worm of the sea, spinner of cloth of gold," a neglected account, full of natural history and history; she does not document the allusion to 'Cloth of Gold,' and she was unable herself to confirm the report attributed to *Gentleman's Magazine*; a friend had supplied a bit of work in Sea-silk but there seems no indication that it was of contemporary manufacture.

Turner, Ruth D., and Joseph Rosewater, "The Family Pinnidae," a notably full and useful account, with good illustrations; p. 291, a photograph of a glove of Sea-silk made at Taranto, USNM No. 149395; I have been unable to get additional information on the glove; their suggestion, p. 292, that two kinds of pearls may be produced by Pinna is one that I have not seen confirmed but it might account for reports of valuable, as well as easily shattered, pearls in Pinna; they believe, pp. 285-286, that the nacreous, anterior portion of the shell may produce normal pearls.

Uffizi Gallery, Florence. *Uffizi / Florence*; I assume the diaphanous garments draping figures in Botticelli's "La Primavera" may be of the sort that Father Minasi, in Carducci's edition of Aquino, thought to have been made of Sea-silk; 'Tarantine' the cloth may be: whether Sea-silk, I doubt.

V., T., "La soie marine," a popular account with some allusions that are not readily tied to accounts that I have seen; the use of the term "Ablaque" for Sea-silk was a mystery until I stumbled across it in the *Grand Larousse*; includes photograph of a purse in the Monaco Musée Océanographique; apparent references to extensive beds of Pinna today may be questioned.

Vacca, Nicola, *Terra d'Otranto: Fine Settecento inizi Ottocento*, a work cited by Peluso that I have not seen; it contains letters from Tanza, vicar general of Archbishop Capeceletro in regard to correspondence of latter with Catherine II of Russia.

Vallardi, Giuseppe, *Itinéraire d'Italie*, a most interesting guidebook; reference to Tarentine woollens, the Tarantula dancers, p. 242; p. 246, Reggio and its workers in Sea-silk; p. 250, Palermo's workers in Sea-silk; I am unable to guess why Sea-silk was 'drab' at Reggio and 'of surprising beauty' at Palermo.

Vincentiis, Domenico Ludovico de, *Storia di Taranto*; on p. 19, a reference to Pinna at Taranto is cited by Peluso.

Waite, J. Herbert, Professor of Marine Biochemistry, University of Delaware College of Marine Studies, several letters and other favors, for which I am most grateful.

Way, Kathie, "Invertebrate collections" (of Sir Hans Sloane; see Arthur MacGregor, 1994), p. 110; item 4912, is "A pair [now only one] of men's gloves made of the beard of the *pinna marina* in Andalusia in Spaine sent me by His Grace the Duke of Richmond"; Way writes: "One of the most curious items connected with the invertebrate exhibits is a glove made from the byssus of a *Pinna* shell" (she reproduces a color photograph of 4912 on p. [101]); she notes, further, the reaction of a twelve-year-old boy, upon visiting the British Museum in 1780: "... There was a pair of gloves made from the beards of mussels, ... and a crocodile, which was such a monstrous great thing, he could have eaten three or four men for a breakfast.' "

Whitehead, Peter James Palmer, and Colin Keates, *The British Museum Natural History*, p. 87, gloves (short-cuffed) shown; Richard Rutt has reported to me on the holdings of BM(NH).

Yates, James, *Textrinum Antiquorum*, several references to knitting at Taranto, pp. 155, etc., the place that he accounted the center of activity in Sea-silk in his time and in the previous century; he was skeptical of any connection of it with the ancient interest in Sea-silk.

A Comic Relief: Pinna In Fiction

How has Pinna fared in *real* fiction, compared to the pretty tales that myth-mongers have stone-walled as unimpeachable truth? One can hardly ask for a writer more likely to qualify in the popular mind as a purely fictional writer than Jules Verne (1828-1905). While

Verne knew his Pinna lore, the average English or American reader of *Twenty Thousand Leagues Under the Sea* will have little reason to remark upon Verne's command of that knowledge.

A modern French writer, T.V., alludes to Verne's treatment of Sea-silk. 'One is reminded of Captain Nemo and the sailors of the *Nautilus*, clothed in *ablaque*,' that enabled them to enjoy the elegance of superior dress.

You will search in vain for a meaning for this statement, if you use ordinary English versions of *Vingt Mille Lieues sous les Mers* that have appeared in numerous editions since about 1871. Not only must you use a recent version with restored text: you will have additional trouble with the term *ablaque*. It is not to be found in conventional French dictionaries. A visit to the *Nouveau Larousse Illustré* is necessary to put you on a firm trail that leads to Pinna.

Now, according to Walter James Miller's "completely restored ... edition" of Verne's classic, the most commonly used translation is a widely copied one done quite early on by one Lewis Page Mercier. Miller counted 15 editions of his translation in print in the United States in 1976. Mercier's translations seem uniformly to have appeared under the name of "Louis Mercier" or "Mercier Lewis." Miller's "restored edition" is merely Mercier's with his own version of the substantial number of passages left out by Mercier (some 23% of the total volume, by Miller's estimation) inserted in square brackets. (Miller's 'restoration' is sufficient to demonstrate my thesis that Pinna was pretty much translated out of the version of the story likely to be seen by English readers; I leave to purists whether the result is what Verne truly wrote.)

Actually, the main damage was done early in the novel. In one of his orotund monologues, Captain Nemo is deflated by the translator's scissors. Our narrator, Professor Aronnax, was listening with delight. Suddenly, the ax falls and the reader is deprived of 16 lines of text, part of which is a detailed reference to Sea-silk. The matter eliminated – that is, in the restored version, entered in square brackets – is the following, obviously vital to our understanding: "But this ocean, M. Aronnax, this inexhaustible great provider, does more than just

feed me. She clothes me as well. Those materials you are wearing are woven from the fibres of certain shell-fish. They have been dyed with the purple of the ancients and shaded with violet that I extract from the Mediterranean sea hare." Further: "Your mattress is made from the softest sea-grass," a reference to another fiber from the sea, probably from the marine plants *Zostera* or *Posidonia*, that has at times perhaps been confused, as *lana marina*, with Sea-silk.

It is true that later, we find that M. Aronnax stretched himself, without square brackets, on his "couch of *zostera*," but you lack information needed to put the material in biotic context.

Then, on the 9th of November, M. Aronnax arose from sleep. "As soon as I was dressed I went into the saloon." What the ordinary English or American reader will not know is that a whole paragraph has been eliminated that tells in what material he dressed himself: "I put on my garments, all made of byssus. This fabric had excited the curiosity of Conseil. I told him that it was made from the glossy, silken threads with which certain bivalve molluscs – quite common on the Mediterranean coast – attach themselves to rocks. In olden days, these silken filaments were woven into a soft, warm cloth from which beautiful gloves and stockings were made. Since the crew of the *Nautilus* had ready access to this byssus, they did not have to depend on sheep, silkworm, or cotton plant for their clothing."

On the 10th of November, M. Aronnax began keeping his journal, writing on "paper made from the *zostera marina*." At least, so much escaped the translator's disapproving eye.

Later, there is the somber account of a burial of a dead comrade of Captain Nemo, the body being "enveloped in a tissue of white byssus," a material that is not further explained here; perhaps it was originally intended by Verne to mean something different from Pinna's Sea-silk, although he does not anywhere indicate 'byssus' to be other than the common biological term for the mollusk hold-fast.

When the *Nautilus* cruised near a submarine volcano in the Mediterranean, the ambient heat caused great distress and M. Aronnax was obliged to take off his coat of byssus – with no explanation as to

what the peculiar fabric was.

It is true that one has enough of the original story to take notice of Verne's use of the word 'byssus,' but which of the one and twenty possible dictionary meanings of that word would the curious reader settle for, if he did not have as a guide Verne's explanatory paragraphs – available until recently only to the readers of the original French version?

References

Nouveau Larousse Illustré, 1(1): 20; *ablaque* is a "nom vulgaire" of a silk or byssus possessed by certain bivalve mollusks – as well, sometimes, as ordinary silk, or a silk of Persia, of very good quality.

V., T., "La soie marine."

Verne, Jules, *The Annotated Jules Verne / Twenty Thousand Leagues Under the Sea*, "The only completely restored and annotated edition," by Walter James Miller; a useful edition especially noted for its effort not only to restore passages left out by the early English translator but because of its abundance of marginal explanations and illustrations of natural history; the major deletions by the translator are the long and vital paragraphs on pages 67 and 95; other references are not bracketed (pp. 94, 96, 168, 222) but convey no meaning to the English/American reader without the deleted matter; Miller relates a few facts about Mercier on pp. xxi-xxii. See also: Verne, Jules, *The Complete Twenty Thousand Leagues Under the Sea*, "A new translation," with introduction and notes by Emanuel J. Mickel; it was done from the complete French edition of 1871 – while the editor, naturally I suppose, finds fault with Miller's edition, his references to byssus, etc., seem not very different from Miller, which I have used, and annotations of scientific matters are not as complete; I am able, overall, to find nothing new on Mercier, the early English translator.

References

- [1] Abbott, R. Tucker, 1972. *Kingdom of the Seashell*. New York: Crown.
- [2] Abbott, R.T., 1974. *American Seashells*. 2nd edition. New York: Van Nostrand Reinhold.

- [3] Abd Allah Ibn Ahmad, called Ibn al-Baitar, 1877-1883. *Traité des Simples*, transl. by (Nicole) Lucien Leclerc. 3 volumes. Paris: Imp. Nationale.
- [4] Abd Allah Ibn Ahmad, see: Joseph von Sontheimer.
- [5] Abu al-Qasim Kalaf Ibn 'Abbas al-Zahrawi. 1861. *La Chirurgie d'Abulcasis*, transl. by (Nicole) Lucien Leclerc. Paris: J.B. Bailliére.
- [6] Abulfeda, see: J.T. Reinaud and S. Guyard, 1848-1883.
- [7] Aelian (Aelianus), Claudius, 1918. *Aelian. On the Characteristics of Animals*, translated by A.F. Schofield. 3 volumes. London: Heinemann.
- [8] Ahrens, Karl, and G. Hoffmann, 1892. *Das "Buch der Naturgegenstände"*. Kiel: C.F. Haeseler. (A Syriac version of the *Physiologus*.)
- [9] Albertus Magnus (St Albert the Great), 1987. *Man and the Beasts / De Animalibus (Books 22-26)*. Translated by J.J. Scanlan. Binghamton: Medieval & Renaissance Texts and Studies.
- [10] Alciphron, see: A.R. Benner and F.N. Fobes.
- [11] Algoud, Henri, 1930. "Byssus and sea-silk." *La Soierie de Lyon*, 13: 169-175.
- [12] Allan, Joyce, 1934. "Silk from shells: an ancient industry." *Australian Museum Magazine*, 5: 220-223.
- [13] Amato, Ivan, 1991. "Stuck on mussels; a mollusk's natural grasp of adhesive science captivates biochemists." *Science News*, 139: 8-9, 15; 5 Jan.
- [14] André, Jacques, 1956. *Lexique des Termes de Botanique en Latin*. Paris: C. Klincksieck.
- [15] Andreas, Saint, Abp. of Crete, 1860. *Orationes. Oratio XXI*. In *Vitam Humanam et in Defunctis*. Paris: J.B. Migne, *Patrologiae Cursus Completus*, vol. 48, cols. 1018-1034.
- [16] Anon., 1782(?). (Revival of Sea-silk industry at Taranto and Regio.) *Gentleman's Magazine* (date is incorrect; see note in chapter on Taranto.)
- [17] Anon., 1782. (Letters on age of knitting industry in England.) *Gentleman's Magazine*, 52: 76, 229.

- [18] Anon., 1944. *2000 Years of Silk Weaving*. New York: E. Weyhe.
- [19] Anon., 1972. *Encyclopedia of Textiles*, 2nd edition, by the editors of American Fabrics Magazine. Englewood Cliffs: Prentice-Hall.
- [20] Anon., 1991. "Geweven goud." *Spectrum, Dierencyclopedie*, 4: 1401.
- [21] Anon., 1993. *Tissus d'Égypte Témoins du Monde Arabe VIII^e-XV^e Siècles*. Thonon-les-Bains: Éditions l'Albaron (etc.).
- [22] Apicius, 1958. *The Roman Cookery Book; a Critical Translation of the Art of Cookery*, by Barbara Flower and Elisabeth Rosenbaum. London: Harrap.
- [23] Apostolius, Michael, see: E.L. von Leutsch and F.G. Schneidewin, 1839-1851.
- [24] Aquino, Tommaso Niccolò d', 1771. *Delle Delizie Tarantine Libri IV. Opera Postuma*, by Cataldanton Atenisio Carducci. Napoli: Stamp. Raimondiana. (Reprint, Bologna: Arnaldo Forni Editore, 1979.)
- [25] Aristophanes, 1924. The Lysistrata. *Aristophanes*, translated by B.B. Rogers, volume 3: 2-123. London: Heinemann.
- [26] Aristophanes, 1983. The Wasps. *The Comedies of Aristophanes*, volume 4, edited by A.H. Sommerstein. Warminster: Aris & Phillips.
- [27] Aristotle, 1476. *De Animalibus (containing) De Animalibus Historia De Animalium ... De Animalium Generatione*, translated by Theodor Gaza. Venice. (Cited in Van der Feen.)
- [28] Aristotle, 1910. *Historia Animalium*, translated by D'Arcy Wentworth Thompson (The Works of Aristotle, Smith and W.D. Ross, volume 4). Oxford: Clarendon Press.
- [29] Aristotle. 1943. *Generation of Animals*, with English translation by A.L. Peck. London: Heinemann.
- [30] Aristotle, 1965. *Historia Animalium*, with English translation by A.L. Peck. 2 volumes. London: Heinemann.
- [31] Arrianus, Flavius, 1961-1978. *Arrian*, with English translation by E. Iliff Robson. 2 volumes. Cambridge: Harvard University Press.
- [32] Artemidorus Daldianus, 1975. *The Interpretation of Dreams / Oneirocritica*, translated by Robert J. White. Park Ridge: Noyes Press.
- [33] Arthrasastra, see: Kautilya; R. Thapar.
- [34] Athenaeus, 1951. *The Deipnosophists*, with English translation by Charles Burton Gulick. 7 volumes. London: Heinemann.
- [35] al-Azdi, Muhammad ibn Ahmad, 1902. 'Abulkâsim,' *ein bagdâder Sittenbild*, edited by Adam Mez. Heidelberg: C. Winter's Universitätsbuchhandlung.
- [36] Bacon, Janet Ruth, 1925. *The Voyage of the Argonauts*. London: Methuen.
- [37] Baines, Sir Edward, 1835. *History of the Cotton Manufacture in Great Britain*. London: Fisher, Fisher & Jackson. (2nd edition, New York: A.M. Kelley, 1965.)
- [38] Baitar, al-Baitar, etc., see: Abd Allah Ibn Ahmad.
- [39] Baker, Patricia L., 1991. "An Abbasid silk fragment." *Hali (International Journal of Oriental Carpets and Textiles)*, 59: 100-101 + notes in appendix.
- [40] Balfour, Edward Green, 1885. *The Cyclopaedia of India and of Eastern and Southern Asia, Commercial, Industrial, and Scientific: Products of the Mineral, Vegetable, and Animal Kingdoms, Useful Arts and Manufactures*, 3rd edition, 3 volumes. London: Quaritch.
- [41] Barber, Elizabeth J.W., 1991. *Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Ages, with Special Reference to the Aegean*. Princeton: Princeton University Press.
- [42] Barber, Richard, 1993. *Bestiary: Being an English Version of the Bodleian Library, Oxford, M.S. Bodley 764*. Woodbridge: Boydell Press.
- [43] Basil, Saint, the Great, Abp. of Caesurea, 1857. *S. Basilii Magni ... Opera Omnia*, edited by J.-P. Migne. 2 volumes. Paris: Migne.
- [44] Basil, Saint, the Great, Abp. of Caesurea, 1963. *Saint Basil, Exegetic Homilies*, translated by Sister Agnes Clare Way. Washington: Catholic University of America Press.
- [45] Basso-Arnoux, Giuseppe, 1916. *Sulla Pesca ed Utilizzazione della "Pinna Nobilis" e del Relativo Bisso*. Roma: Tip. ditta Ludovico Cecchini, for Ministero dell'Industria, del Commercio e del Lavoro. Ispettorato Generale dell'Industria, Divisione XIX - "Sezione Pesca." 9 pp.
- [46] Baytar, al-Baytar, see: Abd Allah ibn Ahmad.

- [47] Beauregard, Henri, 1901. *Matière Médicale Zoologique, Histoire des Drogues d'Origine Animale*. Paris: Naud.
- [48] Beck, S. William, 1882. *The Draper's Dictionary. A Manual of Textile Fabrics: their History and Applications*. London: The Warehousemen & Drapers' Journal Office.
- [49] Beckmann, John, 1846. *History of Inventions, Discoveries and Origins*, 4th edition. Translated by W. Johnston, revised by W. Francis and J.W. Griffith. 2 volumes. London: Bohn.
- [50] Bel, Alfred, and P. Ricard, 1913. *Le Travail de la Laine à Tlemcen (Industries Indigènes de l'Algérie)*. Alger: A. Jourdan.
- [51] Bene, Rita del, 1937. *Tessuti di bisso / Lana-pinna o lana-pesce*. Taranto: 1^a Mostra Jonica d'Arte Sacra, 2-31 Maggio 1937-XV. 7 pp.
- [52] Benner, Allen Rogers, and Francis H. Fobes, 1962. *The Letters of Alciphron, Aelian and Philostrastus*. Cambridge: Harvard University Press.
- [53] Bernier, François, 1891. *Travels In the Moghul Empire AD 1656-1668*, translated by Irving Brock, edited by Archibald Constable. 2nd edition. Oxford: Oxford University Press. (Reprint, Delhi: S. Chand, 1968.)
- [54] Bezon, Jean, 1856-1867. *Dictionnaire Général des Tissus Anciens et Modernes*. 8 volumes + atlas. Lyon: T. Lépaigne.
- [55] Biberg, Isac. Isacson, 1751. *Oeconomia naturae ... Upsaliae 1749 (C. Linnaeus, Amoenitates Academicæ, 2[xix])*. Holmiae: L. Salvium.
- [56] Bino, Narciso, 1987. *Lire Funeste*. Taranto; cited in G. Peluso.
- [57] Blandamura, Giuseppe, 1923. *Il Duomo di Taranto nella Storia e nell'Arte*. Taranto; cited in G. Peluso.
- [58] Blandamura, Giuseppe, 1925. *Choerades Insulae (Le Cheradi del Jonio)*. Taranto; cited in G. Peluso.
- [59] Blümner, Hugo, 1912. *Technologie und Terminologie der Gewerbe und Künste bei Griechen und Römern*, 2nd edition. 4 volumes. Leipzig: Teubner. (Reprint, Hildesheim: G. Olms, 1969.)
- [60] Bock, Franz, 1884. *Goldstickereien und Webereien in alter und neuer Zeit und das dazu verwandte Goldgespinnst*. Nuremberg: Bayrischen Gewerbemuseum.

- [61] Boeggild, Ova Balthasar, 1930. The shell structure of the mollusks. *Mémoires de l'Académie Royale des Sciences et des Lettres de Danemark*, Copenhagen, Section des Sciences, 9th ser., 2(2).
- [62] Bolts, William, 1772. *Considerations on India Affairs; Particularly Respecting the Present State of Bengal and Its Dependencies*, 2nd edition. London: Ptd. for J. Almon.
- [63] Boutan, Louis Marie Auguste, 1925. *La Perle*. Paris: Librairie Octave Doin.
- [64] Brehm, Alfred Edmund, 1893. *Brehms Tierleben Bd. 10; Die Niederen Thiere*, by Oskar Schmidt, new edition by William Marshall. 3rd edition. Leipzig & Wien: Bibliographisches Institut.
- [65] Bretschneider, Emil, 1871. *On the Knowledge Possessed by the Ancient Chinese of the Arabs and Arabian Colonies*. London: Trübner.
- [66] Bretschneider, Emil, 1888. *Mediaeval Researches from Eastern Asiatic Sources*. 2 volumes. London: Trübner. Revised edition, 1910.
- [67] Brückner, Eduard, 1882. "Das Pflanzenschaf (Baranetz)." *Russische Revue*, 21: 131-146.
- [68] Brunello, Franco, 1973. *The Art of Dyeing in the History of Mankind*, translated by Bernard Hickey. Vicenza: N. Pozza.
- [69] Bühler, Kristin, 1948. "Basic textile techniques." *CIBA Review*, 63: 2290-2320.
- [70] Buonanni, Filippo, 1681. *Ricreatione dell'Occhio e della Mente nell'Ossevation' della Chiocciola*. Roma: Varese. Reprinted, with reproductions of original drawings, Milan, 1988.
- [71] Busbecq, Ogier Ghislin de, 1881. *The Life and Letters*, by Charles Thornton Forster and F.H. Blackburne Daniell. 2 volumes. London: Kegan Paul.
- [72] Calman, William Thomas, 1911. *The Life of Crustacea*. London: Methuen.
- [73] Cannon, John, 1994. "Botanical collections," pp. 136-149, in: Arthur MacGregor, ed., *Sir Hans Sloane*.
- [74] Capecelatro, Giuseppe, Abp. of Taranto, 1780. *Spiegazione delle Conchiglie che si Trovano nel Piccolo Mare di Taranto*. Naples. (See: L. Sada; cited in Peluso.)

- [75] Capecelatro, Giuseppe, 1782. *Memoria su i Testacei di Taranto Classificati Secondo il Sistema del Ch. Linneo*. (Cited in Peluso.)
- [76] Caputo, Giacomo, and Richard Goodchild, 1955. "Diocletian's price-edict at Ptolemais (Cyrenaica)." *Journal of Roman Studies*, 45: 106-115.
- [77] Carducci, Cataldo [Cataldanton] Antonio Atensio; see: T.N. d'Aquino.
- [78] Carmichael, W.L., George E. Linton and Isaac Price, 1947. *Callaway Textile Dictionary*. La Grange: Callaway Mills.
- [79] Carrubba, Robert W., 1993. "Engelbert Kaempfer and the myth of the Scythian lamb." *Classical World*, 87(1): 41-47.
- [80] Casson, Lionel, 1989. *The Periplus Maris Erythraei*. Princeton: Princeton University Press.
- [81] Cerruti, Attilio, 1938. "Primi esperimenti di allevamento della "Pinna nobilis" nel Mar Piccolo di Taranto." *La Ricerca Scientifica* (Italy, Consiglio Nazionale delle Ricerche, Rome), year 9, 1: 339-347.
- [82] Chau Ju-Kua, 1911. *Chau Ju-Kua: His Work on the Chinese and Arab Trade in the Twelfth and Thirteenth Centuries, Entitled Chu-fan-chi*, translated and edited by Friedrich Hirth and W.W. Rockhill. St. Petersburg: Imperial Academy of Sciences Press. (Reprint, Amsterdam: Oriental Press, 1966.)
- [83] Chavannes, Édouard, 1907. Editorial note 4, "Le pays d'occident d'après le Heou Han Chou," T'oung Pao, 1907, pp. 183-184.
- [84] Chemnitz, Johann Hieronymus, 1777. "Von der Steckmuschel und ihrer Seide, wie auch von dem Pinnenwäcker." *Der Naturforscher* (Halle), 10: 1-37.
- [85] Chemnitz, J.H., 1785. See: F.H.W. Martini & J.H. Chemnitz.
- [86] Christensen, Aage Moeller, and John J. McDermott, 1958. "Life-history and biology of the oyster crab, *Pinnotheres ostreum* Say." *Biological Bulletin*, 114(2): 146-179.
- [87] Cicero, Marcus Tullius, 1931. *De Finibus Bonorum et Malorum*, with an English translation by H. Rackham. London: Heinemann.
- [88] Cicero, M.T., 1950. *De Natura Deorum / On the Nature of the Gods*, pp. 175-333, in: *Brutus* (etc.), translated by Hubert M. Poterat. Chicago: University of Chicago Press.

- [89] Cicero, M.T., 1968. *De Natvra Deorum*, edited by Arthur Stanley Pease. Cambridge: Harvard University Press.
- [90] Clabburn, Pamela, 1976. *The Needleworker's Dictionary*. New York: Morrow.
- [91] Cocks, W.P., 1862. "Addenda to the Falmouth fauna." *Annual Report of the Royal Cornwall Polytechnic Society*, Falmouth, 30: 19-22.
- [92] Coco, F.A.P., 1928. *Studi, Ricerche e Curiosita Attraverso le Cronache e gli Splendori Antichi*. Taranto. (Cited in Peluso.)
- [93] Cofrancesco, A.J., 1993. "Dyes, natural." New York: John Wiley, *Kirk-Othmer Encyclopedia of Chemical Technology*, 4th ed., 8: 784-809.
- [94] Combelles, S., J.C. Moreteau and N. Vicente, 1986 (1988). "Contribution à la connaissance de l'écologie de *Pinna nobilis* L. (Mollusque: Eulamellibranche)." *Travaux Scientifiques (Parc Nationale de Port-Cros)*, France, 12: 29-43.
- [95] Constantinus VII, Porphyrogenitus, Emperor of the East, 1829, 1830. *De Cerimoniis*, translated and edited by Johann Jakob Reiske. 2 volumes in 1. Bonnae: Weber.
- [96] Constantinus VII, 1862. *De thematibus. Patrologiae cursus Completus*, 58, columns 605-632. Paris: Migne.
- [97] Cook, M., 1970. "Composition of mussel and barnacle deposits at the attachment interface." R. Manly, editor. *Adhesion in Biological Systems*, pp. 139-150. New York: Academic Press.
- [98] Cooke, W.D., and Mohamed El-Gamal, 1990. "Ancient textile technology - the hand spinning of ultra-fine yarns." *Bulletin du CIETA* (Centre International d'Etude des Textiles Anciens, Lyon), Number 68: 69-74.
- [99] Copplestone, Trewin, ed.. 1961. *Pompeian Frescoes ... Masterpieces in Colour*. London: Batchworth Press.
- [100] Cordiner, James, 1807. *A Description of Ceylon*. 2 volumes. London: Longman, Hurst, Rees and Orme. (Reprint, New Delhi: Navrang, 1983.)
- [101] Cotte, Jules, 1944. *Poissons et Animaux Aquatiques au Temps de Pline: Commentaires sur le Livre IX de l'Histoire Naturelle de Pline*. Paris: Paul Lechevalier.

- [102] Cratinus Comicus, 1957. See: Vol. 1, pp. 15-153, John Maxwell Edmonds, 1957-1961.
- [103] Craven, Keppel Richard, 1821. *A Tour through the Southern Provinces of the Kingdom of Naples*. London: Rodwell & Martin. (Order of forenames varies.)
- [104] Crowfoot, Grace M., 1931. Methods of hand spinning in Egypt and the Sudan. *Bankfield Museum Notes*, Halifax, 2nd series, Number 12: 1-51.
- [105] Dalley, Stephanie, 1991. "Ancient Assyrian textiles and the origins of carpet design." *Iran (Journal of Persian Studies, British Institute of Persian Studies)*, 29: 117-135.
- [106] Dalrymple, Alexander, 1770-1771. Account of some natural curiosities at Sooloo. Part of: *An Historical Collection of Several Voyages and Discoveries in the South Pacific Ocean*. 2 volumes. London: Dalrymple.
- [107] Darboux, Jean Gaston, et al., 1906. "Soie marine." Vol. 1, P. 122, in: *L'Industrie des Pêches aux Colonies*. (Exposition Coloniale de Marseille, 1906.) Marseille: Barlatier.
- [108] Daremberg, Charles Victor, and Edmond Saglio, 1873-1919. *Dictionnaire des Antiquités Grecques et Romaines*. 5 volumes in 7. Paris: Hachette. (Reprint, Graz: Akademische Druck- und Verlagsanstalt, 6 volumes in 10.)
- [109] Daumas, François, et al., 1988. *Valeurs Phonétiques des Signes Hiéroglyphiques d'Époque Gréco-Romaine*. Montpellier: Institut d'Égyptologie, Université Paul-Valéry. 3 vols.
- [110] Dávila, Pedro Francisco, 1767. *Catalogue Systématique et Raisonné des Curiosités de la Nature et de l'Art*. 3 volumes. Paris: Briasson.
- [111] Dezallieres d'Argenville, Antoine Joseph, 1742. *L'Histoire Naturelle Éclaircie dans deux de ses Parties Principales la Lithologie et la Conchyliologie*. Paris: De Bure l'Âiné. (Dezallieres is variously spelled.)
- [112] Dezallieres d'Argenville, A.J., 1757. *L'Histoire Naturelle Éclaircie ... La Zoomorphose, ou Représentation des Animaux vivans qui Habitent les Coquilles*. 2 parts in 1 volume. Paris: De Bure l'Âiné.
- [113] Diderot, Denis, and Jean Le Rond d'Alembert. See: *Encyclopédie*.

- [114] Dioscordides of Anazàrbos, Pedanius, 1610. *Kräuterbuch des uralten und in aller Welt berühmtesten Griechischen Skribenten Pedacii Dioscoridis Anazarbei*. Frankfurt am Mayn: Gedruckt durch J. Bringern in Verlegen C. Corthoys. (Reprint, München: Verlag Konrad Kölbl, 1968.)
- [115] Dioscorides of Anazàrbos, Pedanius, 1959. *The Greek Herbal of Dioscorides, Illustrated by a Byzantine AD 512; Englished by John Goodyer AD 1655*, edited 1933 by Robert T. Gunther. New York: Hafner Publ. Co.
- [116] Dobson's Encyclopaedia, see: *Encyclopaedia Britannica*, 1789(1790)-1803.
- [117] Douglas, Norman, 1929. *Birds and Beasts of the Greek Anthology*. New York: Jonathan Cape & Harrison Smith.
- [118] Dozy, Reinhart Pieter Anne, 1877-1881. *Supplément aux Dictionnaires Arabes*. 2 volumes. Leyden: Brill. (3rd edition, 1967.)
- [119] Dozy, R.P.A., 1913. *Spanish Islam*, translated by Francis Griffin Stokes. New York: Duffield.
- [120] Ecsedy, Hilda, 1975. "Böz - an exotic cloth in the Chinese Imperial Court." *Altorientalische Forschungen*, 3: 145-153.
- [121] Edinburgh Encyclopaedia, 1808-1813 (etc.). Conducted by David Brewster. Edinburgh: Ptd for A. Balfour (etc.). (There were several editions.)
- [122] Edmonds, John Maxwell, 1957-1961. *The Fragments of Attic Comedy, after Meineke, Bergk, and Kock*, translated into English. 3 volumes in 4. Leiden: E.J. Brill. Cratinus: 1: 15-153; Nicostratus, 2: 28-43.
- [123] Empedocles, 1981. *Empedocles: The Extant Fragments*, edited M.R. Wright. New Haven: Yale University Press.
- [124] Eiclopedia Italiana Di Scienze, Lettere Ed Arti, 1949-1952. "Bisso." Vol. 7, p. 106. Rome: Istituto della Enciclopedia Italiana, Fondata da Giovanni Treccani.
- [125] Encyclopaedia Britannica, 1st edition, 1771. "Byssus" (etc.). Vol. 1, p. 697. Edinburgh: Ptd. for A. Bell and C. Macfarquhar.
- [126] Encyclopaedia Britannica, 11th edition, 1910-1911. "Silk," by Frank Warner, vol. 25, pp. 96-107. Cambridge & New York: Cambridge University Press.

- [127] Encyclopaedia; or, A Dictionary of Arts ... The first American edition, in eighteen volumes, greatly improved. Philadelphia: Printed (and managed) by Thomas Dobson. Byssus, 3: 805; Pinna, 14: 759-760; Pinnoteres, etc., 14: 760; Silk (silkworm only), 17: 478-487.
- [128] Encyclopaedia of Islam, edited by Sir Hamilton Alexander Gibb, et al., 1954-ff. 7 volumes (still in progress) + *Supplements*, fasc. 1-2-ff., 1980-ff. Leiden: E.J. Brill. (See: *Suppl.*, fasc. 1: 19-20, "Abu barakish," by F. Viré.)
- [129] Encyclopédie De L'Islam, 1913-1936. 4 volumes. Leyde: E.J. Brill.
- [130] Encyclopédie ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers, edited by MM. Diderot and d'Alembert, 1751-1772. 17 volumes text, 12 volumes plates, 2 volumes index. Paris (etc., etc.).
- [131] Estienne, Henri (Henricus Stephanus), 1954. ... *Thesaurus Graecae Linguae*. 8 volumes in 9. Chicago: Argonaut.
- [132] Etchécopar, R. D., and François Hüe, 1964. *Oiseaux du Nord de l'Afrique de la Mer Rouge aux Canaries*. Paris: Éditions N. Boubée & Cie.
- [133] Eustathius, Saint, Abp. of Thessalonika, 1688. *Dionysii Orbis Descriptio*. Londini: Typis M. Clark, Impensis R.L. Littlebury, et al.
- [134] Evelyn, John, 1955. *The Diary of John Evelyn. Now First Printed in Full*; edited by E.S. de Beer. 6 volumes. Oxford: Clarendon Press.
- [135] Faber, G.A., 1938. "Dress and dress materials in Greece and Rome." *CIBA Review*, 1(9): 296-306.
- [136] Favart d'Herbigny, Christoph Elisabeth, M. l'Abbé, 1775. *Dictionnaire d'Histoire Naturelle, que Concerne les Testacées ou les Coquilles*. 3 volumes. Paris: Bleuet.
- [137] Feen, P.J. van der, 1949. "Byssus." *Bacteria*, 13(4): 66-71.
- [138] Fleischer, Heinrich Leberecht, 1836. *De Glossis Habichtianis*. Leipzig: Fr. Chr. Guil. Vogel.
- [139] Fonseca, C.D. (Cosimo Damiano?), date? *Puglia Ieri. Il Regno di Napoli in Prospettiva dell'Abate Gio. Battista Pacichelli*. Bari. (Cited in Peluso; see perhaps G.B. Pacichelli.)
- [140] Forbes, Robert James, 1956-ff. *Studies in Ancient Technology*. 9 volumes. Leiden: E.J. Brill. (Byssus, 2nd edition, vol. 4, 1964.)

- [141] Forbes, William T.M., 1930. "The silkworm of Aristotle." *Classical Philology*, 25: 22-26.
- [142] Forskael, Petter (Pehr), 1775. *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium; quae in Itinere Orientalis Observavit Petrus Forskal*. Hauniae: Mölleri.
- [143] Franc, André, 1960. "Classe des bivalves." In: Pierre-P. Grassé, ed., *Traité de Zoology*, vol. 5: 1845-2133.
- [144] Frank, Tenney, 1940. *An Economic Survey of Ancient Rome. Vol. V. Rome and Italy of the Empire*. Baltimore: Johns Hopkins Press. See also: The edict of Diocletian on maximum prices, by Elsa Rose Graser, pp. 305-421.
- [145] Frondel, Clifford, 1988. "Benjamin Franklin's purse and the early history of asbestos in the United States." *Archives of Natural History*, 15: 281-287.
- [146] Gagliardo, Giovanni Battista, 1811. *Descrizione Topografica di Taranto*. Napoli: Angelo Trani.
- [147] Gardiner, Sir Alan Henderson, 1964. *Egyptian Grammar, Being an Introduction to the Study of Hieroglyphs*. 3d ed. London: Oxford University Press for Griffith Institute, Ashmolean Museum.
- [148] Gardiner, Mary S., 1972. *The Biology of Invertebrates*. New York: McGraw-Hill.
- [149] Gaulejac, Beatrice de, and Nardo Vicente, 1990. "Écologie de *Pinna nobilis* (L.) mollusque bivalve sur les côtes de Corse. Essais de transplantation et expériences en milieu contrôlé." *Haliotis*, 10: 83-100.
- [150] Gayangos, Pascual de, 1840-1843. *The History of the Mohammedan Dynasties in Spain*. 2 volumes. London: Ptd. for the Oriental Translation Fund of Great Britain and Ireland. (Reprint, New York: Johnson Reprint Corp., 1964.) From a work by Ahmed ibn Muhammad al-Maqqari.
- [151] Gaza, Theodorus. See: Aristotle, 1476.
- [152] Geijer, Agnes, 1982. *A History of Textile Art*. Revised edition. New York: Sotheby Publications.
- [153] Geoffroy, Claude Joseph ("Geoffroy le Jeune"), 1710 [1712]. "Observations sur le bézoard et sur les autres matières qui en approchent." *Histoire de l'Académie Royale des Sciences, Mémoires* (Paris), 12: 235-242.

- [154] Geoffroy, C.J., 1712 [1714]. "Suite des observations sur les bézoards." *Histoire de l'Académie Royale des Sciences, Mémoires* (Paris), 14: 202-212.
- [155] Gervers-Molnár, Veronika, ed., 1977. *Studies in Textile History*. Toronto: Royal Ontario Museum.
- [156] Gessner (Gesner), Konrad, 1558. *Historiae Animalium (Liber IV) De Piscium et Aquatiliu Natura*. Tiguri: C. Froshoverum.
- [157] Giannettasio, Nicolò Partenio, 1689. *Halieutica*. Napoli: Officina Jacobi Raillard.
- [158] Gibbon, Edward, 1879. *The History of the Decline and Fall of the Roman Empire*; notes by H.H. Milman. 6 volumes. New York: Harper & Bros.
- [159] Gigante, Nicola, 1986. *Dizionario Critico Etimologico del Dialecto Tarantino*. Manduria: Lacaita.
- [160] Gilroy, Clinton G., 1845. *The History of Silk, Cotton, Linen, Wool, and Other Fibrous Substances*. New York: Harper & Bros.
- [161] Ginanni, Count Giuseppe, 1755-1757. *Opera Postume t. 2. Testacei Marittimi Paludosi e Terrestri dell' Adriatico Territorio di Ravenna*. 2 volumes in 1. Venezia: G. Fossati (and G. Zerletti).
- [162] Goitein, Solomon Dob Fritz, 1967-1988. *A Mediterranean Society*. 5 volumes. Berkeley: University of California Press.
- [163] Goodman, Steven M., and Peter L. Meininger et al., eds., *The Birds of Egypt*. New York: Oxford University Press.
- [164] Gordon, Alexander, n.d. Yates, James (1789-1871). *Dictionary of National Biography*, vol. 21: 1210-1211.
- [165] Grave, Benjamin H., 1909 [1911]. "Anatomy and physiology of the wing-shell, *Atrina rigida*." *Bulletin of the [U.S.] Bureau of Fisheries*, 29: 409-439, plates 48-50.
- [166] Gray, Mrs Maria-Emma (Smith), 1857. *Figures of Molluscous Animals*. Vol. 5, plates 368, 369. London: Longman, Brown, Green & Longmans.
- [167] Gubernatis, Conte Angelo de, 1872. *Zoological Mythology or the Legends of Animals*. 2 volumes. London: Trübner. (Reprint, New York: Arno Press, 2 volumes in 1, 1978.)

- [168] Haas, Fritz, 1955. "Natural history of the pearls." *Comunicaciones del Instituto Tropical de Investigaciones Científicas de la Universidad de El Salvador*, 4: 113-126.
- [169] Hamd Allah, Mustawfi Qazvini, 1928. *The Zoological Section of the Muzhatn-l-Qulub of Hamdulla al-Mustavfi al Qazvini (14th Century)*, edited by John Stephenson. London: Oriental Translation Fund, n.s., Royal Asiatic Society.
- [170] Handschin, E., 1946. "Silk moths." *CIBA Review*, number 53, pp. 1902-1935.
- [171] Harmuth, Louis, 1915. *Dictionary of Textiles*. New York: Fairchild Publishing Co.
- [172] Harting, P[Pieter?], 1857. "Iets over zeespinners." *Album der Natur*, Haarlem, Leyden, pp. 348-352.
- [173] Hasselquist, Fredrik, 1766. *Voyages and Travels in the Levant in the Years 1749, 50, 51, 52*. London: Ptd. for L. Davis and C. Reymers.
- [174] Heine, Rolf, 1969. "Lana marina." *Museum Helveticum*, 26: 48-52.
- [175] Herodotus, 1960. *A Lexicon to Herodotus*, by J. Enoch Powell, 2nd edition. Hildesheim: Georg Olm.
- [176] Hesychius, of Alexandria, 1858-1868. *Lexicon*, edited by Moritz W.C. Schmidt. 5 volumes. Ienae: F. Maukii. (Reprint, Amsterdam: Adolf M. Hakkert, 1965.)
- [177] Hidalgo y Rogríguez, Joaquín González, 1917. *Fauna Malacológica de España, Portugal y las Baleares. Moluscos Testaceos Marinos*. Madrid: Museo Nacional de Ciencias Naturales, Trabajos, serie Zoológica, number 30.
- [178] Hignette, Michel, 1983. "Croissance de *Pinna nobilis* Linne (Mollusque eulamellibranche) après implantation dans la reserve sous-marine de Monaco." *International Commission for the Scientific Exploration of the Mediterranean Sea*, Monaco, 28(3): 237-238.
- [179] Hirth, Friedrich, 1885. *China and the Orient: Researches into their Ancient and Mediaeval Relations as Reported in Old Chinese Records*. Shanghai & Hong Kong: Kelly & Walsh. (Reprint, New York: Paragon Book Reprint Corp., 1966.)
- [180] Holme, Charles, ed., 1913. "Peasant art in Italy." *The Studio*, London, special number, Autumn; also French edition, *L'art rustique en Italie*.

- [181] Horace; see: Horatius.
- [182] Horapollon (Horapollo), 1943. "Traduction des *Hieroglyphica* d'Horapollon." By Baudouin van de Walle and J. Vergote. *Chronique d'Égypte*, no. 35: 39-89; 36: 199-239; see also: 44: 251-259, 1947, by J. Janssen, B. van de Walle and J. Vergote.
- [183] Horapollon (Horapollo), 1950. *The Hieroglyphics of Horapollo*, translated by George Boas. New York: Pantheon Books (Bollingen Series XXIII).
- [184] Horatius, Quintus Horatius Flaccus, 1926. *Horace; Satires, Epistles and Ars Poetica*. English translation by H. Rushton Fairclough. London: Heinemann.
- [185] Hornell, James. 1905. *Report to the Government of Madras on the Indian Pearl Fisheries in the Gulf of Mannar*. Madras: Ptd. by the Superintendent, Government Press.
- [186] Hornell, James, 1951. *Indian Molluscs*. Bombay: The Bombay Natural History Society.
- [187] Hortus Sanitatis (Major)(English), 1954. *An Early English Version of Hortus Sanitatis a Recent Bibliographical Discovery*, by Noel Hudson. London: Bernard Quaritch.
- [188] Houlihan, Patrick F., and Steven M. Goodman, 1986. *The Birds of Ancient Egypt. With ... a Preliminary Checklist to the Birds of Egypt*. Warminster: Aris & Phillips.
- [189] Hugo De St. Victor, alleged author, 1854. *Opera Omnia Editio Nova*, edited by J.P. Migne. 3 volumes. Paris: Migne. (Patrologiae Cursus Completus Scriptorum Latini, ser. secunda, t. 175-177.)
- [190] Huntingford, G.W.D. 1980. *The Periplus of the Erythraean Sea, by an Unknown Author*. London: Hakluyt Society (Works, 2nd ser., 151, for 1976.)
- [191] Ibn al-Baitar (al-Baytar); see: Abd Allah ibn Ahmad.
- [192] Ibn Fadl Allah al-'Umari, Ahmad ibn Yahya, 1927. *Masalik el absar fi mamalik el amsar par ... al-'Omari ... I. L'Afrique Moins l'Égypte*. Translated by Maurice Gaudefroy-Demombynes. Paris: P. Geunther. (Bibliothèque des Géographes Arabes, t. 2.)
- [193] Ibn 'Idhari, al-Marrakushi (Ibn 'Idari), 1901-1904. *Histoire de l'Afrique et de l'Espagne Intitulée Al-bayano'l-Moqrib*. Translated by Edmond Fagnan. 2 volumes. Alger: Imp. Orientale P. Fontana.

- [194] Ideler, Julius Ludwig, 1841-1842. *Physici et Medici Graeci Minores*. 2 volumes. Berlin: G. Reimeri. (Reprint, Amsterdam: Adolf M. Hakkert, 1963, 2 volumes in 1.)
- [195] al-Idrisi, 1866. *Description de l'Afrique et de l'Espagne par Edrisi*, translated by R. Dozy and M.J. de Goeje. 2 volumes. Leyde: E.J. Brill. (Reprint, Leyden: Brill, 1968.)
- [196] Imamuddin, S.M., 1963. *Economic History of Spain (under the Umayyads, 711-1031 AC)*. Dacca: Asiatic Society of Pakistan, Publ. 11.
- [197] Imamuddin, S.M., 1965. *Some Aspects of the Socio-economic and Cultural History of Muslim Spain 711-1492 AD*. Leiden: E.J. Brill.
- [198] Imhoof-Blumer, Friedrich, and Otto Keller, 1889. *Tier- und Pflanzenbilder auf Münzen und Gemmen der klassischen Altertums*. Leipzig: B.G. Teubner.
- [199] Isidorus Characenus (Isidorus of Charax), 1914. *Parthian Stations of Isidore of Charax. An Account of the Overland Trade Route between the Levant and India in the First Century BC*, translated by Wilfred Harvey Schoff. Philadelphia: The Commercial Museum.
- [200] Isidorus, Saint, Bp. of Seville, 1911. *Etymologiarum sive Originum Libri XX*, edited by W.M. Lindsay. 2 volumes. Oxford: Clarendon Press.
- [201] Istakhri, Abi Ishaq Ibrahim (Muhammad al-Farisi). For translations from Arabic, see: Jacob, 1892; Laufer, 1915; Lombard, 1978; Serjeant, 1951.
- [202] Iversen, Erik, 1958. "Hieroglyphic studies of the Renaissance." *The Burlington Mag.*, 100: 15-21, figures 26-36, January.
- [203] Jacob, Georg, 1892. *Studien in arabischen Geographen*, Heft II. Berlin: Mayer & Muller.
- [204] Jeffreys, John Gwyn, 1862-1869. *British Conchology, or an Account of the Mollusca which now Inhabit the British Isles*. 5 volumes. London: J. Van Voorst.
- [205] Johnston, George, 1850. *An Introduction to Conchology*. London: John Van Voorst.
- [206] Kalkashandi (Ahmed ibn 'Ali al-Qalqashandi), 1913. (An Arabic dictionary.) For translation of 'Wabar al-samak' (= "Fish-down"), 5: 142, see R.B. Serjeant.

- 207] Karabacek, Josef, Ritter von, 1882. *Über einige Benennungen mittelalterlicher Gewebe*. Wien: Author.
- 208] Kautalya (Kautilya), 1951. *Kautilya's Arthashastra*, translated by J.F. Fleet, 4th edition. Mysore: Sri Raghuvveer Printing Press.
- 209] Keller, Otto, 1909-1913. *Die antike Tierwelt*. 2 volumes. Leipzig: W. Engelmann.
- 210] Keyssler, Johann Georg, 1756-1757. *Travels through Germany, Bohemia, Hungary, Switzerland, Italy and Lorrain*. 4 volumes. London: A. Linde (etc.). (First German ed., 1740.)
- 211] Lane, Frank Walter, 1960. *Kingdom of the Octopus*. New York: Sheridan House.
- 212] Larousse, Pierre (et al.), 1898-1904. *Nouveau Larousse Illustraté*. 7 volumes. Paris: Librairie Larousse.
- 213] Larousse, Pierre (et al.), 1928-1933. *Larousse de XX^e Siècle*. 6 volumes. Paris: Librairie Larousse.
- 214] Latrobe, Benjamin Henry, 1977. *The Virginia Journals ... 1795-1798* (volume 2, 1797-1798), edited by Edward C. Carter II et al. New Haven: Yale University Press (and Maryland Historical Society).
- 215] Laufer, Berthold, 1915. "The story of the Pinna and the Syrian lamb." *Journal of American Folklore*, 28: 103-128.
- 216] Lauffer, Siegfried, ed., 1964. *Diokletians Preisedikt*. Berlin: De Gruyter.
- 217] Lee, Henry, 1887. *The Vegetable Lamb of Tartary*. London: Sampson, Low, Marston, Searle & Rivington.
- 218] Lefkowitz, Mary, 1992. "The twilight of the goddess." *The New Republic*, 3 August, pp. 29-33.
- 219] Leggett, William F., 1949. *The Story of Silk*. New York: Lifetime Editions.
- 220] Leutsch, Ernst Ludwig von, and F.G. Schneidewin, eds., 1839-1851. *Corpus Pseudoepigraphorum Graecorum*. 2 volumes. Göttingen: Vandenhoeck & Ruprecht. (Reprint, Hildesheim: G. Olms, 1965.) Reference is to Apostolius et Arsenius, vol. 2.
- 221] Levrault, F.G., et al., eds., 1804-1840. *Dictionnaire des Sciences Naturelles*. 60 volumes + 12 volumes color plates, 1 volume portraits. Reference is to vol. 32, 1824.

- [222] Lewis, Randolph V., 1992. "Spider silk: the unraveling of a mystery." *Accounts of Chemical Research*, 25(9): 392-398.
- [223] Liddell, Henry George, and Robert Scott, 1925-1940. *A Greek-English Lexicon*, new ed. by H.S. Jones et al. Oxford: Clarendon Press.
- [224] Linné (Linnaeus), Carolus. See: Biberg, Hasselquist, A. Murray.
- [225] Linton, George Edward, 1973. *The Modern Textile and Apparel Dictionary*, 4th edition. Plainfield: Textile Book Service.
- [226] Lombard, Maurice, 1978. *Les Textiles dans le Monde Musulman du VII^e au XII^e Siècle*. Paris & New York: Mouton.
- [227] London, The Great Exhibition, 1851. *Great Exhibition of the Works of Industry of All Nations, 1851*, Official Catalogue, edited by Robert Ellis. 3 volumes. London: Spicer Brothers.
- [228] London, International Exhibition, 1862. *The Illustrated Catalogue of the Industrial Department*. 4 volumes. London: Ptd. for Her Majesty's Commissioners. Vol. 4, Foreign Division.
- [229] Lovell, M.S. 1867. *The Edible Mollusca of Great Britain and Ireland, with Recipes for Cooking Them*. London: L. Reeve.
- [230] Lowell, James Russell, 1892. *Literary Essays*. 4 volumes. Boston: Houghton Mifflin. See: "Leaves from my journal in Italy and elsewhere," 1: 100-217.
- [231] Lucas, F., J.T.B. Shaw and S.G. Smith, 1955. "The chemical constitution of some silk fibroins and its bearing on their physical properties." *Shirley Institute Memoirs* (Didsbury), 26: 77-89.
- [232] Lutz, Henry Frederick, 1923. *Textiles and Costumes among the Peoples of the Ancient Near-East*. Leipzig: J.C. Hinricho; New York: G.E. Stechert.
- [233] McCrindle, John Watson, 1973. *The Commerce and Navigation of the Erythraean Sea ... Followed by Ancient India as Described by Ktesias the Knidian*. Amsterdam: Philo Press (reprinted from editions of Calcutta & London, 1879, 1882).
- [234] McCulloch, Florence, 1962. *Mediaeval Latin and French Bestiaries. University of North Carolina Studies in the Romance Languages and Literature*, number 33 (revised).
- [235] McCulloch, Florence, 1965. "Mermecolion - a Mediaeval Latin word for 'Pearl oyster.'" *Mediaeval Studies*, 27: 331-334.

- [236] Macdowall, David W., 1964. "The early Western satraps and the date of the Periplus." *Numismatic Chronicle*, 7(4): 271-280.
- [237] MacGregor, Arthur, ed., 1983. *Tradescant's Rarities. Essays on the Foundation of the Ashmolean Museum 1683 with a Catalogue of the Surviving Early Collections*. Oxford: Clarendon Press. 1 volume + microfiche.
- [238] MacGregor, Arthur, ed., 1989. *The Late King's Goods*. London & Oxford: Alistair McAlpine & Oxford University Press.
- [239] MacGregor, Arthur, ed., 1994. *Sir Hans Sloane, Collector, Scientist, Antiquary, Founding Father of the British Museum*. London: British Museum Press/Alistair McAlpine.
- [240] Makdisi, etc.; see: al-Muqaddasi.
- [241] Makkari (al-Maqqari), Ahmad ibn Muhammad. See: Gayangos, Lombard, Serjeant.
- [242] Maravigna, Carmelo, 1850. "Monografia delle specie del genere *Pinna* di Linneo alla Sicilia." *Atti dell' Accademia Gicenia de Scienze Naturali di Catania*, (2) 7: 179-191.
- [243] Marks, Stephen S., ed., 1959. *Fairchild's Dictionary of Textiles*. New York: Fairchild Publications.
- [244] Marquardt, Karl Joachim, 1964. *Das Privatleben der Römer*. 2 volumes. Darmstadt: Wissenschaftliche Buchgesellschaft. (First published 1886.)
- [245] Martialis, Marcus Valerius, 1919-1920. *Martial, Epigrams*, with English translation by Walter C.A. Ker. 2 volumes. London: Heinemann.
- [246] Martini, Friedrich Heinrich Wilhelm, et al., 1769-1829. *Neues systematisches Conchylien-Cabinet*. 12 volumes. Nürnberg: Gabriel Nicolaus Raspe (etc.). J.H. Chemnitz, q.v., was author of volumes 4-11.
- [247] Mastrocinque, Beniamino, 1928. *Bisso e Porpora / Per la Rinnascita delle Due Grandi Industrie*. Taranto: Consiglio Provinciale dell'Economia di Taranto.
- [248] Mauersberger, Herbert R., ed., 1947. *Matthews' Textile Fibers, their Physical, Microscopical, and Chemical Properties*, 5th edition. New York: John Wiley & Sons.

- [249] Menander, of Athens, 1930. *Menander, the Principal Fragments*, with English translation by Francis Greenleaf Allison. London: Heinemann.
- [250] Mendes Da Costa, Emmanuel, 1776. *Elements of Conchology*. London: Ptd. for B. White.
- [251] Meyer, Hermann Julius, 1889-1890. *Meyers Konversations-Lexikon*. 'New Edition.' 17 volumes. Leipzig: Verlag des Bibliographischen Instituts. (Various editions exist.)
- [252] Mez, Adam, 1937. *The Renaissance of Islam*, translated by Salahuddin Khuda Bukhsh (Bakhash) and D.S. Margoliouth. London: Luzac. (Reprint, New York: AMS Co., 1975.)
- [253] Mommsen, Theodor, and Hugo Blümner, 1958. *Edictum Diocletiani de Pretiis Rerum Venalium / Der Maximaltarif des Diocletian*, 2nd edition. Berlin: Gualterum de Gruyter & Socios. (Original edition, 1893.)
- [254] Müller, Karl, of Paris, 1965. *Geographi Graeci Minores (etc.)*. 2 volumes. Hildesheim: Georg Olms Verlagsbuchhandlung. (Reprint of edition of 1855-1861, etc.) Contains 'Periplus of the Erythraean Sea,' with commentary.
- [255] Muhlenberg, Henry, 1796 (1799). "Supplementum Indicis Florae Lancastriensis." *American Philosophical Society, Transactions*, series 1, 4(28): 235-242.
- [256] Mukharji, T.N., 1888. *Art-manufactures of India. Especially Compiled for the Glasgow International Exhibition, 1888*. Calcutta: Ptd. for the Superintendent of Government Printing, India.
- [257] al-Muqaddasi, Muhammad ibn Ahmad, 1950. *Description de l'Occident Musulman au IV^e-X^e Siècle*, French translation by Charles Pellat. Alger: Editions Carbonel. (Bibliothèque Arabe-française, 9.)
- [258] Murphy, William S., et al., 1910-1911. *The Textiles Industries*. 8 volumes. London: Gresham.
- [259] Murray, Adolf, 1785. *Fundamenta Testaceologiae. Amoenitates Academicae* (C. Linnaeus), 8 (clviii).
- [260] Murray, Margaret Alice, 1910. The tomb of the two brothers (etc.). *The Manchester Museum, Museum Handbooks*, Publication 68.
- [261] Nagy, Lajos (Ludwig), 1935. Aquincumi Múmia-Temetkezéssek ... Múmiabegräbnisse aus Aquincum. *Dissertationes Pannonicae Musei Nationalis Hungarici*, series 1, Fasc. 4. Magyar Nemzeti Múzeum, Budapest, VIII, Múzeum krt. 14-16.

- [262] Nasir-i Khusraw, 1881. *Sefer Nameh; Relation du Voyage de Nasiri Khosrau ... 437-444 (1035-1042)*. Translated by Charles Schefer. Paris: E. Leroux. (Publications de l'École des Langues Orientales Vivantes, series 2, 1.)
- [263] Naster, Paul, 1959. *Catalogue des Monnaies Grecques. La Collection Lucien de Hirsch*. 2 volumes. Bruxelles: Bibliothèque Royale de Belgique, Cabinet des Médailles.
- [264] Needham, Joseph, 1954. *Science and Civilisation in China. Volume 1. Introductory Orientations*. Cambridge: Cambridge University Press.
- [265] Needler, Winifred, 1977. "Three pieces of unpatterned linen from ancient Egypt in the Royal Ontario Museum." pp. 238-251, in: Veronika Gervers.
- [266] Nemesius, Emesenus, Bp. of Emesa (Syria), 1955. *Cyril of Jerusalem and Nemesius of Emesa*, translated by William Telfer. London: SCM Press.
- [267] Nicander, 1953. *Nicander, the Poems and Poetical Fragments*, edited by A.S. Gow and A.F. Scholfield. Cambridge: Cambridge University Press.
- [268] Nicostratus Comicus; see: J.M. Edmonds, 2: 28-43, 1959.
- [269] Nouveau Larousse Illustraté; see: P. Larousse.
- [270] Odorico Da Pordenone (Friar Odoric), 1904. Friar Beatus Odoricus. Pp. 370-408 (Latin), 408-444 (English), in: Richard Hakluyt, *The Principal Navigations Voyages Traffiques & Discoveries of the English Nation*, vol. 4. Glasgow: James MacLehose
- [271] Oppianus, 1928. *Oppian / Colluthus / Tryphiodorus*, with English translation by A.W. Mair. London: Heinemann.
- [272] Osing, Olga, n.d. "Silk from the sea." *Sea Secrets*, pp. 18-21.
- [273] Oxford English Dictionary, 1933. "Byssus," "Byssine," vol. 1, pp. 1238-1239. Oxford: Clarendon Press.
- [274] Pacichelli, Giovanni Battista, 1703. *Il Regno di Napoli in Prospettiva Diviso in Dodici Provincie*, Opera postuma, 3 pts. Napoli. Cited in Peluso; see Fonseca.
- [275] Pal, Pratapaditya, 1983. *Court Paintings of India*. New York: Navin Kumar.

- [276] Panciroli, Guido, 1715. *The History of Many Memorable Things Lost, Which Were in Use Among the Ancients*. 2 volumes in 1. London: Ptd. for J. Nicholson & sold by J. Morphew.
- [277] Parenzan, Pietro, 1960. *Il Mar Piccolo di Taranto*. Roma: Giovanni Semerano Editore.
- [278] Paris, Exposition des Produits de l'Industrie Française, 1806. *Rapport du Jury sur les Produits de l'Industrie Française*. Paris: Imp. Imperiale. (See: T.V., 1988.)
- [279] Paris, Exposition Universelle, 1867. *Complete Official Catalogue, Including the British and All other Sections. English Version*. London: J.M. Johnson.
- [280] Passow, Franz, 1970. *Handwörterbuch der Griechischen Sprache*. New ed. by V.C.F. Rost and F. Palm. 2 volumes in 4. Darmstadt: Wissenschaftliche Buchgesellschaft. (Originally publ. 1841-1857.)
- [281] Paton, W.R., 1916-1918. *The Greek Anthology*. 5 volumes. London: Heinemann.
- [282] Pauly, August Friedrich von, and Georg Wissowa, 1894-1965. *Paulys Real-Encyclopädie der classischen Altertumwissenschaft*, new ed. by G. Wissowa. 24 volumes in 49. Stuttgart: J.B. Metzler.
- [283] Pausanias, 1918. *Description of Greece*, with English translation by W.H.S. Jones. 5 volumes. London: Heinemann.
- [284] Pausanias, 1965. *Pausanias's Description of Greece*, translation and commentary by James G. Frazer. 6 volumes. New York: Biblio & Tannen. (First published 1898.)
- [285] Pease, Arthur Stanley, 1941. "Caeli enarrant." *Harvard Theological Review*, 34(3): 163-200.
- [286] Pellat, Ch., 1954. "Gahiziana, I / Le Kitab al-Tabassur bi-l-tigara attribué à Gahiz." *Arabica* (Revue d'Études Arabes, Leyden), 1: 153-165.
- [287] Pelliot, Paul (Eugène), 1959. *Notes on Marco Polo*. 3 volumes. Paris: Imp. Nationale.
- [288] Pelseneer, Paul, 1935. *Essai d'Éthologie Zoologique d'après l'Étude des Mollusques*. Bruxelles: Palais des Académies.
- [289] Peluso, Giacinto, 1993. "L'industria Tarantina del bisso fra tradizione e storiografia." *Cenacolo* (Società di Storia Patria per la Puglia, Sezione di Taranto), December.

- [290] Pérès, Henri, 1983. *Esplendor de al-Andalus: La Poesía Andaluza en Arabe Clássico en el Siglo XI*. Spanish translation by Mercedes García-Arenal. Madrid: Hiperion.
- [291] Perry, Ben E., 1941. "Physiologus." Pauly-Wissowa, vol. 20, pt. 1, columns 1074-1129.
- [292] Petrócchi, Policarpo, 1906. *Nòvo Dizionario Universale della Lingua Italiana*. 2 volumes. Milano: Fratelli Trèves.
- [293] Pfister, R., 1934. *Textiles de Palmyre*. Paris: Les Éditions d'Art et d'Histoire.
- [294] Philes, Manuel, 1730. *Phile De Animalium Proprietate*. Trajecti ad Rhenum: G. Stouw.
- [295] Philo Judaeus. See: G. Tappe.
- [296] Philostratus, Flavius, 1912. *The Life of Apollonius*, with English translation by F.C. Conybeare. 2 volumes. London: Heinemann.
- [297] Philostratus, *Letters*. See: Alciphron.
- [298] Pierpont, Robert, et al., 1910. "Limerick glove in a walnut shell" (and replies). *Notes & Queries*, series 11, 2: 249, 297.
- [299] Piersanti, Carlo, 1926. *I Molluschi e le Conchiglie*. Milano: Ulrico Hoepli.
- [300] Plinius Secundus, Caius (Pliny the Elder), 1938-1962. *Natural History*, with English translation by H. Rackham et al. 10 volumes. London: Heinemann.
- [301] Plutarchus, 1927-1969. *Plutarch's Moralia*, with English translation by Frank Cole Babbitt, et al. 16 volumes. London: Heinemann. With reference to "The cleverness of animals."
- [302] Poeppig, Eduard Friedrich, 1848. *Illustrierte Naturgeschichte des Thierreichs. Vierter Band. Naturgeschichte der wirbellosen Thiere*. Leipzig: J.J. Weber.
- [303] Poli, Giuseppe Saverio, 1791-1795. *Testacea Vtrvsqve Siciliae*. 2 volumes. Parme: Regio Typographio.
- [304] Pollard, Albert Frederick, 1902. *Henry VIII*. London: Goupil.
- [305] Pollux, Julius, of Naucratis, ed., 1706. *Onamastikon*. 2 volumes. Amstellaedami: Wetsteniana.

- [306] Polo, Marco, 1875. *The Book of Ser Marco Polo, the Venetian*, ed. by Sir Henry Yule. 2 volumes. London: John Murray.
- [307] Polo, Marco, 1912. *The Travels of Marco Polo the Venetian*. Translation by William Marsden, revised; edited by Thomas Wright. London: G. Bell.
- [308] Polwhele, Richard, 1831. *Biographical Sketches in Cornwall*. 3 volumes in 1. Truro: Ptd. by W. Polyblank for J.B. Nichols & Son.
- [309] Procopius, of Caesarea, 1914-1940. *Procopius*, with English translation by H.B. Dewing. 7 volumes. London: Heinemann. (Buildings / De Aedificiis is in vol. 7.)
- [310] Ravera, Oscar, 1950. "Ricerche sul bisso e sulla sua secrezione." *Pubblicazioni della Stazione Zoologica di Napoli*, 22: 95-105.
- [311] Réaumur, Antoine de, 1711. "Des differentes manieres dont plusieurs especes d'animaux de mer s'attachent au sable, aux pierres, & les uns autres." *Histoire de l'Académie Royale des Sciences*, 24: 109-136, 2 plates.
- [312] Réaumur, Antoine de, 1717 (1720). "Observations sur le coquillage appellé Pinne Marine, ou Nacre de Perle; à l'occasion duquel on explique la formation des perles." *Histoire de l'Académie Royale des Sciences, Mémoires*, Année 1717, pp. 177-194, plates 4, 5.
- [313] Rees, Abraham, 1805-1825. *The Cyclopaedia; or, Universal Dictionary*, 1st American edition. 41 volumes, 6 volumes plates. Philadelphia: Ptd. by Carr for Samuel F. Bradford.
- [314] Regling, Kurt Ludwig, 1924. *Die antike Munze als Kunstwerk*. Berlin: Schoetz & Parrhysius.
- [315] Reil, Theodor, 1913. *Beiträge zur Kenntniss des Gewerbes im hellenistischen Ägypten*. Borna-Leipzig: R. Noske. (Reprint, New York: Arno Press, 1979.)
- [316] Reinaud Joseph Toussaint 1863. *Relations Politiques et Commerciales de l'Empire Romain avec l'Asie Orientale*. Paris: Imprimerie Impériale.
- [317] Reinaud, Joseph Toussaint, and Stanislas Guyard, 1848-1883. *Géographie d'Aboulféda*. 2 volumes in 3. Paris: Imp. Nationale.
- [318] Reiske, Johann Jakob. See: Constantinus VII, 1829-1830.
- [319] Ricci, Elisa, 1913. "Women's crafts." Pp. 17-32, in Charles Holme.

- [320] Riccio, Myriam, 1932. "Il bisso del mare di Sardegna nel Museo Oceanografico di Monaco." *La Tribuna*, 24 Sept.
- [321] Richter, Gisela M., 1930. *Animals in Greek Sculpture: a Survey*. New York: Oxford University Press.
- [322] Riedesel, Johann Hermann, Freiherr von, 1773. *Travels through Sicily and that Part of Italy Formerly Called Magna Graecia, and a Tour through Egypt*. Translated by J.R. Forster. London: E. & C. Dilly.
- [323] Rogers, Julia Ellen, 1951. *The Shell Book*. Revised edition. Boston: Charles T. Branford. (First edition, 1908.)
- [324] Róna-Tas, András, 1975. "Böz in the Altaic world." *Altorientalische Forschungen*, 3: 155-163.
- [325] Rondelet, Guillaume (Gulielmus Rondeletius), 1554-1555. *Libri de Piscibus Marinis* (second volume is entitled: *Universae Aquatiliium Historiae*). Lugduni: Matthiam Bonhomme.
- [326] Royal Scottish Museum (now Royal Museum of Scotland), 1867. *Catalogue of Industrial Department. ... Edinburgh Museum of Science and Art*. Edinburgh: Ptd. by Neill & Co.
- [327] Rutschowskaya, Marie-Hélène, 1990. *Coptic Fabrics*. Paris: Adam Biro.
- [328] Rutt, Richard, 1987. *A History of Hand Knitting*. Loveland: Interweave Press.
- [329] Rymsdyk, John (Jan), and Andrew (Andreas) Rymsdyk, 1778. *Museum Britannicum, Being an Exhibition* (etc.). London: Ptd. by I. Moore for Authors. (There is a variant edition, 1791; authors listed as 'van Rymsdyk,' printed by J. Moore.)
- [330] Sada, Luigi, date? *Perle dei Mari di Puglia*. (Said by Peluso to reproduce Capecelatro's work on shells of the Mare Piccolo.)
- [331] Salis-Marschlins, Karl Ulysses von, 1795. *Travels through Various Provinces of the Kingdom of Naples in 1789*. Translated by Anthony Aufrere. London: T. Cadell, Jr., and W. Davies.
- [332] Sarton, George, 1941 (1942). "Brave Busbecq (1522-1592)." *Isis*, 33: 557-575.
- [333] Sarton, George, 1952. *A History of Science; Ancient Science through the Golden Age of Greece*. Cambridge: Harvard University Press.
- [334] Saunderson, Karen Ann, 1995. "'Cloth of Gold.'" *Handwoven*, 16(5): 7, Nov/Dec.
- [335] Schaefer, Gustav, 1938. "The principle of the loom" [plus essays on looms in antiquity]. *CIBA Review*, 2(16): 542-571.
- [336] Schlegel, Gustaf, 1890. *The Shui-yang or Watersheep in Chinese Accounts from Western Asia and the Agnus Scythicus or Vegetable Lamb of the European Mediaeval Travellers*. Leide: E.J. Brill.
- [337] Schmitter, M.-Th., 1937. "Subsericae vestes." *Revue Archéologique*, 6th series, 9: 201-225.
- [338] Seltman, Charles Theodore, 1955. *Greek Coins; a History of Metallic Currency and Coinage Down to the Fall of the Hellenistic Kingdoms*. 2nd edition. London: Methuen.
- [339] Seneca, Annaeus, 1928. *Moral Essays*, with English translation by John W. Basore. 3 volumes. London: Heinemann. See "De Beneficiis" in vol. 3.
- [340] Serjeant, Robert Bertram, 1951. "Material for a history of Islamic textiles up to the Mongol conquest." *Ars Islamica*, 15-16: 29-85. See "Sea-wool," pp. 60-61.
- [341] Sethi, B.L., et al., 1960-1961. *Cotton in India*. 4 volumes. Bombay: Indian Central Cotton Committee.
- [342] Shiratori, Kurakichi, 1956. "A new attempt at the solution of the Fulin problem: the country of Fu-lu-ni in the Wei-shu." *MTB* (Memoirs of the Toyo Bunko [Tokyo Oriental Library, Research Department]), 15: 165-329.
- [343] Silbermann, Henri, 1897. *Die Seide, ihre Geschichte, Gewinnung und Verarbeitung*. 2 volumes. Leipzig: H.A. Ludwig Degener (etc.).
- [344] Simkiss, K., 1988. "Molluscan skin (excluding cephalopods)." Pp. 11-35, in: E.R. Trueman and M.R. Clarke, eds., *The Mollusca*, vol. 11, Form and Function. New York: Academic Press.
- [345] Simmonds, Peter Lund, 1879. *The Commercial Products of the Sea: or Marine Contributions to Food, Industry, and Art*. London: Griffith & Farran (etc.).
- [346] Simone, Luigi G. de, 1873. *La Madreperla Salentina ed il suo Bioccolo*. Lecce. (Cited in Peluso.)

- [347] Smeathers, J.E., and J.F.V. Vincent, 1979. "Mechanical properties of mussel byssus threads." *Journal of Molluscan Studies*, 45: 219-230.
- [348] Solito, Domenico, 1845. *Descrizione Storico-filosofica delle piu' Rimate Conchiglie che Allignano nel Seno Tarantino*. Rome: Giovanni Battista Zampi.
- [349] Sontheimer, Joseph von, 1840-1842. *Grosse Zusammenstellung über die Kräfte der Bekannten Einfachen Heil- und Nahrungsmittel von Abu Mohammed Abdullah ibn Ahmed aus Malaga bekannt unter dem Namen Eben Baithar*. 2 volumes. Stuttgart: Hallberger'sche Verlagshandlung.
- [350] Sophocles, E.A., 1957. *Greek Lexicon of the Roman and Byzantine Periods (from BC 146 to AD 1100)*. 2 volumes. New York: Frederick Ungar.
- [351] Stackhouse, John, 1815. "Remarks on an error in the Periplus." *Classical Journal* (London), 11: 154-155.
- [352] Staniland, Kay, 1980. "Medieval courtly splendour." *Costume* (Costume Society, Victoria & Albert Museum, London), number 14: 7-23.
- [353] Stauber, Leslie Alfred, 1945. "Pinnotheres ostreum parasitic on the American oyster, *Ostrea (Gryphaea) virginica*." *Biological Bulletin*, 88: 269-291.
- [354] Stebbing, Thomas R.R. 1893. *A History of Crustacea: Recent Malacostraca*. London: Kegan Paul, Trench, Trübner & Co.
- [355] Stephanus, Henricus / Stephano, Henrico. See: Henri Estienne.
- [356] Stephens, Janet Johnson, 1995. "Knitted carpet masterpieces of the Holy Roman Empire." *Piecework* 3(2): 56-61.
- [357] Stolberg, Friedrich Leopold, Graf zu, 1796-1797. *Travels through Germany, Switzerland, Italy and Sicily*. Translated by Thomas Holcroft. 2 volumes. London: Ptd. for G.G. & J. Robinson.
- [358] Suraci, Marco, 1986. "Le conchiglie produttrici della preziosa 'Lana penna.'" *C & S*, March, p. 94.
- [359] Swarup, Shanti, 1968. *5000 Years of Arts and Crafts in India and Pakistan*. Bombay: D.B. Taraporevala.
- [360] Swinburne, Henry, 1790. *Travels in the Two Sicilies ... in the Years 1777, 1778, 1779, and 1780*, 2nd edition. 4 volumes. London: Ptd. by J. Nichols for T. Cadell and P. Elmsly. (Several editions; first, 1783-1785.)
- [361] Tappe, Georgius, 1912. *De Philonis Libro qui Inscibitur ... Quaestiones Selectae*. Göttingen: Dieterich.
- [362] Tavernier, Jean-Baptiste, 1925. *Travels in India*, translated by V. Ball, edited by William Crooke. 2nd edition. 2 volumes. London: Oxford University Press. (Reprint, Lahore: al-Biruni, 1976.)
- [363] Tertullian, Quintus Septemius Florens, 1956. De Pallio. Volume 2, columns 1029-1050, in: *Opera Omnia* (reprinted from Paris edition of 1844). Turnhout, Belgium: Ursines Brepols.
- [364] Thapar, Romila, 1955. "State weaving-shops of the Mauryan period." *Journal of Indian Textile History*, 1: 51-59.
- [365] Theophrastus, 1976. *De Causis Plantarum*. Translated by Benedict Einarson and Georg K.K. Link. 3 volumes. London: Heinemann.
- [366] Theophrastus, 1965. *De Lapidibus*. Translated by D.E. Eichholz. Oxford: Clarendon Press.
- [367] Thiébaud De Berneaud, Arsène (Arsenne), 1814. *A Voyage to the Isle of Elba; with Notices of the Other Islands of the Tyrrhenian Sea*. Translated by William Jerdan. London: Longman, Hurst, Rees, Orme & Brown. First in French, 1799?, 1808, etc.
- [368] Thompson, Charles John Samuel, 1929. *Guide to the Surgical Instruments and Objects in the Historical Series and their History and Development*. London: Ptd. for the College (Hunterian Museum, Royal College of Surgeons).
- [369] Thompson, D'Arcy Wentworth, 1947. *A Glossary of Greek Fishes*. London: Oxford University Press.
- [370] Thompson, D'Arcy Wentworth, 1910. See: Aristotle.
- [371] Thomson, James, 1834. "On the mummy cloth of Egypt; with observations on some manufactures of the ancients." *London & Edinburgh Philosophical Magazine*, 3rd series, 5: 355-365. Reprinted in Baines, 1835, pp. 534-543.
- [372] Tiberi, N., 1879. "Le conchiglie Pompeiana." *Bolletino della Società Malacologica Italiana* 5: 139-151, 262-271.
- [373] al-Tidjani (Tijani, etc.), Mohammad ibn Ahmad, 1852(1853). *Voyage du Scheik et-Tidjani dans la Régence de Tunis, Pendant les Années 706 707 et 708 de l'Hégire (1306-1309 de J.-C.)*. Translated by Alphonse Rousseau. Paris: Impr. Impériale (extracted from *Journal Asiatique*, 4th series, vol. 20).

- [374] Toynebee, Jocelyn M.C., 1973. *Animals in Roman Life and Art*. Ithaca: Cornell University Press.
- [375] Tradescant, John (the Younger), 1656. *Musaeum Tradescantianum: or, a Collection of Rarities*. London: Ptd. by John Grismond. (In MacGregor, 1983.)
- [376] Tristram, Henry Baker, 1911. *The Natural History of the Bible*. 10th edition. New York: E.S. Gorham (etc.).
- [377] Turk, Stella M., 1982. "The silk worm of the sea, spinner of cloth of gold." *Conchologist's Newsletter*, 83: 39-42.
- [378] Turner, Ruth D., and Joseph Rosewater, 1958. "The family Pinnidae in the Western Atlantic." *Johnsonia* (Museum of Comparative Zoology, Harvard), 3(38): 285-326.
- [379] Uffizi Gallery (Florence), 1968. *Uffizi / Florence*. New York: Simon & Schuster (Newsweek / Great Museums of the World).
- [380] 'Umari. See: Ibn Fadl Allah al-'Umari, Ahmad ibn Yahya.
- [381] Uphof, J.C. Th., 1968. *Dictionary of Economic Plants*. 2nd edition. Lehre: J. Cramer.
- [382] V., T., 1988. "La soie marine." *L'Evenement du Jeudi*, 7-13 Jan., p. 113.
- [383] Vacca, Nicola, 1966. *Terra d'Otranto: fine Settecento Inizi Ottocento*. Bari: Società di Storia Patria per la Puglia, Documenti e Monografie, xxxii. (Cited in Peluso.)
- [384] Valeriano Bolzani, Giovanni Pierio, 1976. *Hieroglyphica*, edited by C.A. Curione. New York: Garland. (From an edition published at Lyon in 1602; first edition, 1556.)
- [385] Vallardi, Giuseppe, 1817. *Itinéraire d'Italia ou la Description des voyages par les Routes Plus Fréquentées aux Principales Villes d'Italie*. 9th Milanese edition. Milan: Pierre & Joseph Vallardi.
- [386] Verne, Jules, 1976. *The Annotated Jules Verne: Twenty Thousand Leagues Under the Sea. The Only Completely Restored and Annotated Edition*. By Walter James Miller. New York: Thomas Y. Crowell.
- [387] Verne, Jules, 1991. *The Complete Twenty Thousand Leagues Under the Sea*, a new translation by Emanuel J. Mickel. Bloomington: Indiana University
- [388] Verrill, A. Hyatt, 1950. *Shell Collector's Handbook*. New York: G.P. Putnam's Sons.
- [389] Vial, Gabriel, 1983. "A propos d'une soirée façonnée dite de 'Byssus.'" *Bulletin de Liaison Centre International d'Étude des Textiles Anciens* (now *Bulletin du CIETA*), number 5758, pp. 50-60.
- [390] Vincent, William, 1797-1805. *The Commerce and Navigation of the Ancients in the Indian Ocean*. 2 volumes in 3 parts. London: T. Cadell & W. Davies. (The *Periplus* is in volume 2.)
- [391] Vincent, William, 1814. "Error in the translation of the Periplus of the Erythrean Sea." *Classical Journal*, 10: 323-326.
- [392] Vincentiis, Domenico Ludovico de, 1878-1879. *Storia di Taranto*. Taranto: Latronico. (See Peluso.)
- [393] Viré, F., 1980. "Abu barakish." *The Encyclopaedia of Islam*, new ed., Supplement, Fasc. 1-2, pp. 19-20.
- [394] Vollmer, John E., et al., 1983. *Silk Roads / China Ships*. Toronto: Royal Ontario Museum.
- [395] Waite, J. Herbert, 1983. "Quinone-tanned sclero-proteins." In: Karl M. Wilbur, ed., *The Mollusca*, vol. 1. This volume is separately entitled *Metabolic Biochemistry and Molecular Biomechanics*, edited by Peter W. Hochachka, where see pp. 467-504.
- [396] Waite, J. Herbert, 1991. "Mussel beards: a coming of age." *Chemistry & Industry*, 17: 607-611.
- [397] Waite, J. Herbert, 1992. "The formation of mussel byssus: anatomy of a natural manufacturing process." Pp. 27-54, in: Steven T. Case, ed., *Structure, Cellular Synthesis and Assembly of Biopolymers*. Berlin, etc.: Springer.
- [398] Walle, Baudouin van de, 1961. "Autour des Hieroglyphica d'Horapollon." *Chronique d'Égypte*, 36(71): 106-112.
- [399] Walters, Henry Beauchamp, 1899. *Catalogue of the bronzes, Greek Roman, and Etruscan, in the Department of Greek and Roman Antiquities, British Museum*. London: British Museum.
- [400] Ward, The Rev. William, 1824. *A View of the History, Literature, and Religion, of the Hindoos*. Hartford: H. Huntington, Jr.
- [401] Warmington, Eric Herbert, 1928. *The Commerce Between the Roman Empire and India*, 2nd edition. Delhi: Vikas. (Reprint, New York: Octagon Books, 1974.)

- [402] Watson, Andrew M., 1977. "The rise and spread of Old World cotton." pp. 355-368, in: V. Gervers, ed.
- [403] Watson, John Forbes, 1866. *The Textile Manufactures and the Costumes of the People of India*. London: Ptd. for the India Office by G.E. Eyre and W. Spottiswoode. (Reprint, Varanasi: Indological Book House, 1982.)
- [404] Watt, Sir George, et al., 1889-1896 (etc.). *A Dictionary of the Economic Products of India*. 7 volumes in 10. Calcutta: Superintendent of Government Printing; London: W.H. Allen.
- [405] Way, Kathie, 1994. "Invertebrate collections," pp. 93-111, in Arthur MacGregor, ed., *Sir Hans Sloane*.
- [406] Webb, Walter Freeman, 1942. *United States Mollusca. A Descriptive Manual ...* Rochester: Author (etc.).
- [407] Weibel, Adèle Coulin, 1952. *Two Thousand Years of Textiles; The Figured Textiles of Europe and the Near East*. New York: Pantheon (for Detroit Institute of Arts).
- [408] Wescher, H., 1948. "Cotton in the ancient world." *CIBA Review*, 64: 2322-2360.
- [409] Whitehead, Peter, and Colin Keates, 1981. *The British Museum Natural History*. London: Philip Wilson, for the British Museum (Natural History).
- [410] Wild, John Peter, 1970. *Textile Manufacture in the Northern Roman Provinces*. Cambridge: Cambridge University Press.
- [411] Willis, J.C., and H.K. Airy Shaw, 1973. *A Dictionary of the Flowering Plants and Ferns*, 8th edition. Cambridge: Cambridge University Press.
- [412] Wilson, Kax, 1979. *A History of Textiles*. Boulder: Westview Press.
- [413] Winckworth, R., 1929. "Marine Mollusca from South India and Ceylon. III. *Pinna*. With an index to the Recent species of *Pinna*." *Proceedings of the Malacological Society of London*, 18: 276-297.
- [414] Winckworth, R., 1936. "Marine Mollusca ... X. Further notes on *Pinna*." *Proceedings of the Malacological Society of London*, 22: 20-23.
- [415] Wingate, Isabel B., ed., 1967. *Fairchild's Dictionary of Textiles*, 2nd edition. New York: Fairchild Publications.

- [416] Xenocrates, the Physician, 1841. De alimentis ex fluviatilibus. pp. 121-133, in: J.L. Ideler, *Physici et Medici Graeci Minores*. 2 volumes. Berlin: Reimer. (Reprint, Amsterdam: Hakkert, 1963, in 1 volume.)
- [417] Yates, James, 1843. *Textrinum Antiquorum: Account of the Art of Weaving Among the Ancients*, Part I (all publ.). London: Taylor & Walton.
- [418] Yates, James. See: A. Gordon.
- [419] Yeats, John, 1872. *The Natural History of the Raw Materials of Commerce*, 2nd edition. London & New York: Petter & Galpin.
- [420] Yonge, C.M., 1953. "Form and habit in *Pinna carnea* Gmelin." *Philosophical Transactions, Section B*, Royal Society of London, 237: 335-374.
- [421] Yule, Sir Henry, 1913-1916. *Cathay and the Way Thither*. Revised edition by Henri Cordier. 4 volumes. London: Hakluyt Society, Works, 2nd series, volumes 38, 33, 37, 41 (the order in which the work appeared!). First edition, 1866.
- [422] Yule, Sir Henry, and A.C. Burnell, 1903. *Hobson-jobson. A Glossary of Colloquial Anglo-Indian words and phrases*. New edition. London: John Murray. (First edition, 1886; reprint, Delhi: Munshiram Mancharlal, 1968.)
- [423] Zedler, Johann Heinrich, 1732-1754. *Grosses vollständiges Universal-Lexikon*. 64 volumes + Supplement, 4 volumes. Halle & Leipzig: Verlegts J.H. Zedler (etc.). (Reprint, Graz: Akademische Druck- u. Verlagsanstalt.)

Acknowledgments, With A Note On Methods

While I am an accomplished linguist in English only, I have tried to make available to the reader matter from many languages. Whenever possible, I have used translations into English in standard editions. I have tried to extract the main sense from works in German, French, Italian and Spanish, when they are not available to me in English. Such translations are my own and I give quotations from them in single quotation marks. Citations from published works in English are given in double quotes. If works in Arabic, Greek and Latin are not available in English translation (or by way of French or German authors), I have tried to cite pages of recognized editions and have