LII.—*Notes on the Purple of the Ancients* (continuation).

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3. *Purple Dyeing in Modern Times.*

ALTHOUGH the art of dyeing with shellfish has long been abandoned in the Old World, it is still carried on to some extent in America, especially on the Pacific coasts of Nicaragua and Costa Rica. The process is described in Don Antonio de Ulloa's "Physical and Historical Account of Southern and North-Eastern America." The author says: "On the coasts belonging to the province of Guayaquil the finest purple is found. The animals from which it is derived are contained in shells, about the size of walnuts, and live on rocks washed by the sea. They contain a juice or humour, which is taken out, and yields the true purple. This humour to all appearance serves the animal instead of blood. Cotton, thread, and other delicate materials are dyed with it. It gives a lively and durable colour, which does not lose its lustre by frequent washing, but is rather improved thereby, and does not fade through long-continued use and exposure. Near the port of Nicoya in the province of Guatemala the same kind of shellfish is found, and is used for dyeing cotton. In both places the dyed yarn is employed in making ribands, lace, and other articles, which are afterwards skilfully sewn and embroidered. All such articles are highly prized on account of their fine and rare colour. Various processes are employed for extracting the juice or humour. Some kill the animal. They take it out of its shell, and, having laid it on the back of the hand, press and squeeze it with a knife from the head to the tail, and then separate the expressed juice, the rest of the animal matter being thrown away. They treat in this way a number of animals until they have a sufficient quantity of juice. They then draw through the thread which they wish to dye, and no more is required. But the dyed threads do not show at once the purple colour they should have.

This is not perceived until the whole is thoroughly dry. At first the colour is milk-white, then it becomes green, and finally purple. Others express the juice without killing the animal. They do not take it entirely out of the shell, but only press it so as to cause a certain quantity of humour to be ejected, with which the threads are dyed. The shells are then laid again on the stones from which they were taken. They recover, and after some time give a fresh quantity of juice, but not so much as the first time." (From a note by Schneider in the Appendix to Dieze's German Translation of Ulloa: Leipsic, 1781.)

Of the process of purple dyeing as practised in recent times by the natives of Central America, Squier gives the following account: "Some of the cotton fabrics manufactured by the Indians are very durable and woven in tasteful figures of various colours. The colour most valued is the Tyrian purple, obtained from the murex shellfish, which is found on the Pacific coast of Nicaragua. This colour is produced of any desirable depth and tone, and is permanent, unaffected alike by exposure to the sun and to the action of alkalis. The process of dyeing the thread illustrates the patient assiduity of the Indians. It is taken to the seaside, when a sufficient number of shells are collected, which being dried from the sea water, the work is commenced. Each shell is taken up singly, and a slight pressure upon the valve which closes its mouth forces out a few drops of the colouring fluid, which is then almost destitute of colour. In this each thread is dipped singly, and after absorbing enough of the precious liquid, is carefully drawn out between the thumb and finger, and laid aside to dry. Whole days and nights are spent in this tedious process, until the work is completed. At first the thread is of a dull blue colour, but upon exposure to the atmosphere acquires the desired tint. The fish is not destroyed by the operation, but is returned to the sea, where it lays in a new stock of colouring matter for a future occasion." (Squier's "Nicaragua, its People, Scenery, Monuments, &c.," vol. I, p. 286.)

It would, I imagine, be a matter of some interest to the ethnologist to ascertain whether the art of dyeing purple, as above described, was an original invention of the natives of America, or whether it was introduced into the New World by European settlers. None of the books I have consulted in which the subject is referred to, contain any information on this point, nor even the least surmise.

4. *Examination of a Sample of Purple Yarn from Nicaragua.*

Through the kindness of my friend, Herr von Stralendorff, of Manchester, I have obtained a small quantity of cotton yarn and some

calico, which had been dyed quite recently at Realejo, on the west coast of Nicaragua, together with a specimen of the shell of the animal used for the purpose. Herr von Stralendorff's correspondent, Don Mariano Montealegre, of Chinandega, Nicaragua, through whom the specimens were procured, says that the animal is extracted from its shell by means of a pin or other pointed instrument, the blood furnishing the purple dye.

The shell accompanying the dyed articles, which resembles that of the *Purpura Lapillus* of our coasts, but is much larger, belongs, I am informed, to the *Purpura patula* of conchologists. The yarn and calico were of a dull purple, by no means realising the idea usually entertained of the famous Tyrian dye. They were harsh to the touch and emitted a peculiar smell.

Having taken a portion of the yarn, which after drying weighed 24 grams, I treated it with warm dilute hydrochloric acid. The acid liquid was found to contain in solution much magnesium, a little aluminium and iron, together with calcium sulphate, sodium chloride, and a trace of sodium bromide. These salts were probably derived from the sea water with which one may suppose the body of the mollusc to be permeated, and were doubtless the cause of the harsh, disagreeable feeling of the material. The yarn, after the hydrochloric acid had been washed out, was dried and then treated with boiling ether. The ether which had acquired only a slight colour left on evaporation a residue of a pink hue, consisting for the most part of some fatty acid or acids, probably derived from the tissues of the animal. After passing through these processes, the yarn appeared of a brighter purple than before. It was now treated with boiling aniline, which removed the purple colouring matter, itself acquiring a dark greenish-blue colour. The liquid was filtered boiling hot, and the yarn was again treated with boiling aniline, which sufficed to remove the whole of the colouring matter. The yarn after being well washed with alcohol to remove adhering aniline was dried, when it was found to weigh 19.5 grams. It still retained a brown tinge, which underlying the purple may have been in part the cause of the dull appearance of the latter. The aniline on cooling and standing deposited the colouring matter contained in it in the form of a crystalline powder, which, after being filtered off, washed with alcohol to remove adhering aniline and dried, weighed 0.099 gram.

The colouring matter thus prepared has all the properties of punicin from *Purpura Lapillus* described in a former note.

Seen in the mass it appears of a dark purple colour and crystalline. Under the microscope it is found to consist of flat, right-angled tablets mostly with jagged ends, which by transmitted light show colours varying from reddish-purple to bluish-purple, interspersed with small

rhombic crystals which are much darker and appear blue by transmitted light.

It is insoluble in boiling alcohol and ether, slightly soluble in benzol and glacial acetic acid.

It dissolves easily in boiling aniline, giving a purplish-blue solution, which, on cooling, deposits the whole of the colouring matter contained in it. The solution while hot shows an absorption band between C and D with a well defined edge on the side towards the red, but shading off at the opposite side. The band resembles that of a solution of indigo-blue in aniline, but is somewhat narrower, and does not extend so far towards the red. After standing for some time the solution no longer shows any band, whilst the indigo-blue band only disappears on long standing. The substance also dissolves in boiling phenol, giving a sky-blue solution, which on cooling deposits granular masses of colouring matter, still retaining, however, a blue tinge.

It dissolves in concentrated sulphuric acid, yielding a dull purple solution, which shows an absorption band between D and E. On slightly heating the solution or allowing it to stand for some time, the colour changes to a bright green, and the absorption band disappears. The green solution on the addition of water gives a flocculent precipitate of a lively purple and becomes colourless, from which it may be inferred that the substance yields no sulpho-acids soluble in water, such as are obtained from indigo-blue by treatment with sulphuric acid.

Nitric acid diluted with an equal volume of water which easily decomposes indigo-blue, acts very slowly on this colouring matter even on boiling. It disappears gradually with evolution of nitrous fumes, but even after long-continued boiling small purple particles may be detected floating in the liquid. It also resists the action of a strong solution of chromic acid, with which it may be boiled for a long time without disappearing entirely. This behaviour towards potent oxidisers shows what an extremely stable body this is, and may serve to explain the great permanence which the ancient purple dye was known to possess.

In contact with bromine the substance undergoes on standing a complete change. After evaporation of the excess of bromine a yellow mass is left, which is soluble in boiling alcohol. The solution leaves on evaporation a residue consisting of yellow crystalline needles in star-shaped groups.

It dissolves on treatment with an alkaline solution of stannous oxide, and is again deposited on exposing the solution to the air in the form of a blue pellicle.

On being carefully heated the substance is volatilised, only a trace of residue being left. The sublimate which it yields consists of crys-

tals having, when seen under the microscope, the same form and appearance as those described and figured in a previous note. These crystals show by reflected light a bronze-like lustre, while by transmitted light they appear when not too thick of a deep blue colour. A few thin feathery crystals are usually seen among the more regular ones, which are purple by transmitted light. These variations in colour are, I imagine, due simply to the different thicknesses of substance through which the light passes.

I thought it might be of interest to determine the temperatures at which the substance, which there can be no doubt is identical with the punicin described in a previous note, as well as indigo-blue and indirubin, with which it is nearly allied, begin to sublime. For this purpose minute quantities of the three substances were placed on a glass plate, each being surrounded by a thin metallic ring and covered with a thin glass plate, such as is used for microscopic purposes, resting on the metallic ring, and the whole being heated in a hot air bath. The temperature was noted at which the first indication of a crystalline sublimate could in each case be observed on the glass cover under the microscope; this was for indirubin 140° , for indigo-blue 170° , and for punicin 190° . These temperatures lie so far apart that they may serve to characterise the three substances. From indigo-blue, for which alone it could be mistaken, punicin may most readily be distinguished by the characteristic reaction with sulphuric acid above described.