

The Conchological Society of Great Britain and Ireland

(Founded 1876)

Papers for Students No. 6

POST-PLIOCENE FOSSIL MOLLUSCA (LAND & FRESHWATER)

by

Philip Cambridge

INTRODUCTION

Fossil land and freshwater shells have been known and have attracted the attention of collectors for many years. Pleistocene and earlier deposits were studied first and it was not until fairly recently that much attention was paid to the Holocene deposits. For many years these formed a sort of "No Man's Land"; while geologists looked upon them as too recent for their attention, conchologists considered them outside their scope. In the last twenty or thirty years it has become increasingly obvious that this group of mollusca react very strongly to climatic and other changes in environment and therefore can tell us a great deal about the past.

GEOLOGICAL TIME

Geologists divide the past into periods which are given names to distinguish them, in the same way that historians refer to the "Tudor" or "Reformation" periods, meaning that certain persons lived during that time or certain things were happening. While a number of means exist by which the age of rocks can be estimated in years, geologists generally prefer to refer to these periods. Few people can really understand what is meant by millions of years. The last two of these periods are the Pleistocene and the Holocene. These are difficult to define and separate and some geologists prefer to group them together as the Hologene or Quaternary. During the Pleistocene period the climate varied very much, from warm periods during which Hippopotamus lived in British rivers and shells now found in much more southern countries lived here, to Ice Ages in which most of England was covered by vast masses of ice. In its forward movement this ice obliterated most of the soil and lake deposits containing non-marine shells, but rarely these were preserved in hollows or caves or fissures in the rocks. Later, when the last of the ice sheets retreated, the country was left bare of living things and had to

be re-colonised from the Continent of Europe to which Britain was then still joined. As the ice melted, the many rushing streams and rivers spread clay, sand and gravel over the countryside. Man who had been forced to move south also returned. The period between the end of the Pleistocene and the present day is called the Holocene. There were still many changes in climate, sometimes wetter and sometimes drier than at present. With the spread of man over the country other changes occurred; forests were destroyed; lands were drained and vast areas brought under cultivation, all of which affected the Mollusca living in these regions.

WHERE TO COLLECT

If you examine a sample of soil from almost any locality you are sure to find dead snails in it. These may have died very recently or be several hundreds of years old. Such dead shells are sometimes called "sub-fossils". They will usually belong to species still existing in the area, and for this reason the study of the fossil non-marine shells of an area should start with a survey of the living forms. When you know what species to expect to find living in your area you can compare these with others found in the older layers. Shells which no longer occur living at a site are said to be extinct in that area. Similarly they may be extinct in Britain, though still living elsewhere in the world. Finally a species may be totally extinct.

Between the soil and the bedrock below, other layers may occur, sometimes reaching many feet in thickness. These may be sands, clays, peats, etc. and in a suitable locality each may tell its own story of the shell life of the area. All such layers should be examined carefully for shells. Thus all temporary excavations in your area should be examined. Sometimes the shells are confined to small pockets in the beds and are not scattered throughout.

You should examine all trenches, gravel pits, cuttings, the tops of quarries, etc. Sometimes material may be brought to the surface by grabs or buckets, from below the water level, but great care is required here for the different beds cannot then be examined and several layers may be mixed together. It is important to be certain that the layers you are examining are actually in place, because often soil is moved during quarrying operations, or dumped into old pits, washings from sugar beet factories are spread on fields and so on, all of which can be very misleading. Old soils and their enclosed shells sometimes find their way down into fissures in rocks, especially in Chalk or limestone country, sometimes partly filling caves, and these should be carefully examined. Old soils are often covered by sand dunes and if the dunes move they may be uncovered again. Sea and river cliffs are other obvious places where the upper layers of the earth can be examined.

The student of fossil non-marine shells should never be afraid to dig for himself. Most of the deposits are easily penetrated and in suitable areas large collections can be made in this way. Often, along the edges

of Chalk or limestone country, white marly deposits occur, a few feet below the surface representing the sites of old springs and the white material is often full of shells. Traces of this can be seen in the sides of ditches, ponds, etc. and they are often brought to the surface by burrowing animals. Any likely areas, molehills, the entrances to rabbit burrows, etc., should be examined for signs of shelly deposits.

WARNING. You should always get permission to visit pits, quarries, etc. and to dig on private land. Follow the code of the countryside so that you and other students coming later will always be welcome. Always fill up and stamp down any small holes you dig. It is a good idea to bury a small bottle or other imperishable object in any trial holes you dig so that later collectors will know the site has been disturbed at that point. Finally, pits and quarries can be dangerous! Remember to let someone know where you are going, avoid edges which may crumble, remember falling sand or earth in a trench can easily bury you. No one should be afraid to take sensible precautions.

HOW TO COLLECT

Very often shells of snails, etc. can be seen in the section but many shells are very tiny and are not easily noticed. For this reason, and to be sure that you get a really representative collection, it is best to carry away samples of the soil, clay, peat, etc. and examine them at home. Polythene bags are the best for collecting your samples and can be sealed easily with a twist of soft copper wire. Samples should be taken from each different layer, but also at intervals down the section being examined. Sometimes the species in the upper and the lower part of the same bed may differ showing that conditions were changing, though the material of the bed remains the same.

Each bag should be numbered or bear a suitable label. Remember that ink labels will easily wash out and fade and may be quite indecipherable when the bag is unpacked later. Numbers can be in marking ink or 4B pencil on paper labels, and these are best placed inside the bag. Another good method is to stamp numbers on aluminium discs and put one disc in each bag. Next a sketch should be made of the section, showing the thickness of each different bed, and the points at which your samples were taken marked clearly on this sketch. Sometimes it may be necessary to take samples laterally as well as vertically, especially in a long section, and where the beds may seem to change their character. It is essential that you locate the site exactly on a map, if possible using National Grid Reference Numbers or, if this is not possible, note its distance and direction from some prominent building. It is suggested you give each site a number and/or letter to identify it. Thus in the author's field book "Ho 5/3" is used to mean "Site 5, Hockwold, Norfolk, Sample No. 3" and an accompanying diagram shows where in the section it was collected. Later, when the shells were separated, tubes of shells from this sample and site were labelled "Ho 5/3" thus saving much writing, and the rough sketch in the field notebook was more carefully drawn in Indian Ink in a fair notebook

with a record of all the details. Among the details recorded should be the type of beds, the size and shape of pebbles, gravels, etc., the presence of bones, pottery, etc., indeed anything at all that is observed.

Samples should be as large as possible, and contain at least a pound or two of material.

Each collector will quickly find the tools and materials which best suit himself and the area in which he is collecting. However, some things are fairly essential and these include a stout canvas bag or rucksack, collecting bags of linen or polythene (paper bags or newspaper can be used for dry samples if it is necessary to economise), a notebook, a small trowel or shovel, map of your area, a good hand lens and a few small tubes or boxes containing a little cotton wool for any "prize specimens" seen in the field. It is preferable that your collecting bags are thrown away after use, to prevent contamination of your next samples. If it is necessary to re-use them they should be turned inside out and very carefully cleaned.

PREPARING YOUR MATERIAL

Very rarely shells occur in loose sands and can be separated by merely sieving the sample. More often the matrix is earthy or clayey and must first be broken down. This is best accomplished by first allowing the sample to dry thoroughly. In many of the Holocene deposits it is only necessary to then place the dry sample in a bucket of water and the majority of the shells, being full of air, will float to the surface as the sample breaks up. Gently stir the sample, breaking up any large lumps under water with the hands. Pour the water off through a piece of metal gauze. Add more water, stir and pour off through the sieve and continue until the water is no longer muddy. By now the majority of the shells, together with any vegetable matter, will be in the sieve, so invert it over a sheet of paper and tap out the contents leaving them to dry on the paper. The remnants of your sample can now be sorted on another piece of paper, consisting of the insoluble remnants. Such shells as did not float, slug shells and granules, etc., can be recovered from this remnant. At this stage keep a look out for bones, pieces of pottery, coins, etc. which together with the large stones, etc. can be picked from the residue. Experts can use some of these to help date your finds.

If the matrix is rather clayey, it can be broken down by repeated drying and soaking, and each time a little more of the clay will pass through the sieve. With a little patience the most stubborn samples will finally dissolve into soft mud but the process can be greatly speeded by the addition of chemicals, such as a little Calgon, soda or ammonia.

Having reduced your sample to a few spoonful of shells and shell fragments, these can always be stored for sorting when the weather does not permit field work, but remember to keep all your residues carefully labelled.

SORTING

Before sorting your residues it is preferable to roughly grade your materials as the eye works better on objects of approximately the same size. Prepare a sheet of paper or thin cardboard by ruling off 2" squares with bold lines. You will find these lines a great help as you can search each square in turn. For light coloured material a black surface is better. Daylight is always best for this work; otherwise make sure the lighting is good. Sprinkle a tablespoon of the residue over your paper. Holding the spoon an inch or so over the surface tap the handle lightly with one finger and so spread the residue thinly and evenly over the surface. The higher the spoon is held the more thinly the material can be spread. Pick up the shells and shell fragments using a moistened camel hair brush. Remember the shells are usually very fragile and must be handled very delicately. It will save work later if you have several small trays or boxes into which you can roughly sort your shells as you pick them out. Do not leave specimens in trays; they are too easily upset or mixed. It is best to put your specimens in glass tubes or similar containers with a little cotton wool at the bottom. Nothing is more disheartening than to pick up a batch of specimens and find they are unlabelled and you have forgotten where they came from. There is nothing to be done with specimens which have lost their locality except throw them away. Cork tubes firmly.

Among your residues will be other fossils. In some beds you will find various seeds and these should be carefully saved, for later examination. It is obvious that if you know what plants were living with your shells you will know a great deal about the climate and the type of country in which they lived. It is worth pointing out that in some residues small derived fossils from the underlying rocks also occur, and this is especially so where the rock is Chalk or other soft limestone. These fossils, of course, are very much older than your Quaternary shells, but they can be very confusing, especially to a beginner. In certain clays plant pollen is laid down with the shells. Study of these pollens can result in very accurate dating of the clay but this is a task for very skilled workers and is generally restricted to cases where the age of the beds is scientifically very important.

While most of the equipment you need can be improvised it is essential to buy a good lens. A hand lens will prove satisfactory at first but sooner or later you will need a better aid. Practically all experts use a low-power binocular microscope to identify small species or fragments or to examine the ornamentation on shells. Some of the shells are very small indeed. A magnification of X10 or X15 is most useful. Under the microscope all sorts of other objects will be seen in your samples - the fruits of Chara, little bean-shaped shells of ostracods, fragments of insects and so on.

NAMING YOUR SPECIMENS

Now comes the most difficult part of your work. Do not be disappointed if you find you cannot name all your specimens at once. Even experts often have difficulty in naming certain species. Often the names of genera will be as far as you need to go. Collect recent shells to compare with your fossils; remember it is easier to name a shell when you have the colour to help you. Look at collections in museums. See what books your library has (see list at the end). Finally ask at your local museum or natural history society whether there is anyone with more experience in your locality. They are sure to find some time to help you. In return be co-operative when you have specimens they want.

STORING YOUR COLLECTION

Generally your specimens will need no further preparation. They can be strengthened by painting with very thin solutions of clear "dope" bought at a model aircraft dealers but try to avoid giving the specimens an unnatural shiny look.

A cabinet of some sort is advisable for your specimens but this will depend on how much you can afford or how clever you are at making one. Similarly containers for your shells vary in cost and usefulness. Glass tubes are excellent. Gelatine capsules, bought at a chemists are cheaper, but must be kept dry. Very cheap tubes can be made by wrapping a strip of thin card around a pencil and fastening with a layer of gummed paper. Slide off, place a cotton wool wad at one end, insert specimens and add another wad and you have a container. Small boxes can be made into containers by adding a top of glass or transparent plastic, and neatly sealing with tape, etc. A well laid out collection is well worth the extra work. The collection should be accompanied by a catalogue, giving details of locality, etc., or by a card index system as preferred. Photographs of sections, maps, etc. all add to the usefulness of your collection.

HOW OLD ARE YOUR SPECIMENS?

Here we have another difficult task. It is not always possible to say exactly how old a given deposit is. A knowledge of the later geology of your area will help here. Certain rules which are in use by geologists are essential. First in an undisturbed sequence the oldest beds will always be at the bottom. Look out for the same layers in different parts of your locality. If one of these can be dated by say the presence of Roman pottery, then the same bed elsewhere, even without pottery, can be placed in the same period. Naturally a good deal of experience is needed sometimes to do this.

Archaeological "digs" are good sites for establishing dated deposits. Always get permission from the leader of the excavations and be prepared

to hand over any non-molluscan finds you make. Look out for shells in sealed layers. Thus beneath the floor of a building all the snails will be earlier than the building usually. The nearer the surface the more difficult it is to be certain that later shells have not been mixed into the samples.

As we go back in time, coins, as an aid to dating deposits, disappear and finally so does pottery. Flint implements can be used next and finally all traces of man disappear as we pass into the Pleistocene and it is necessary to judge ages by the presence of extinct species of shells or by the bones of mammals, or plant remains. It is not possible to judge the age of a shell by its appearance. A quite recent shell may be bleached white and worn while a really old fossil shell may retain its colour in a most remarkable way. Specimens of Theodoxus from the Pleistocene often retain all their colour markings.

WHAT YOUR SPECIMENS TELL YOU

When your specimens have all been carefully identified you can learn much from them about the past. In conjunction with your field notes you will now be able to find in your sections ditches which were not permanently full of water (damp-loving snails, Succinea, Lymnaea peregra), ponds and permanently flooded ditches (larger Lymnaeas, planorbids, etc.), rivers (Theodoxus fluviatilis, Unios, Bithynia, etc.). Different types of countryside can be recognised, dry grasslands (Helicellas), woodlands (Ena), flooded fields, and so on. The presence of large numbers of snails indicate warm damp conditions. Sometimes the shells are so abundant as to form white marl, especially the beds of old lakes, near limey springs and so on.

Finally as has already been mentioned, certain shells enable you to give the age of the deposit they are found in. Thus the presence of a small bivalve Corbicula fluminalis would show that you are in freshwater deposits of the Pleistocene period; finding the common garden snail Helix aspersa in your section would prove that the beds are fairly recent, probably after the Roman period. As time goes on you will learn more and more about the different species and the conditions which they liked and by carefully studying an area for some time you can decipher what happened there - the floods, the cutting down of trees and replacement by grasslands and the changes in temperature and rainfall.

ACKNOWLEDGEMENT

Thanks are due to Mr. B. Sparks who read this paper and made a number of valuable suggestions, many of a very practical nature, which have greatly added to the usefulness of the work.

LITERATURE

The literature which could be quoted is vast. Pay a visit to your local library and ask to see any books on the geology of your county. The early Geological Survey Memoirs often give considerable information. The following will suggest many localities still worth visiting:-

- British Museum (Natural History), 1960 British Cenozoic Fossils. London.
- Ellis, A.E., 1926 British Snails. Oxford. (reprinted 1969)
- Ellis, A.E., 1962 Synopsis of the British Fauna: No. 13 - British Freshwater Bivalve Molluscs. Linnean Society of London. London.
- Kennard, A.S., 1923 Holocene Non-Marine Mollusca of England. Proc. Malac. Soc. London, vol. 15, pp. 241-259.
- Kennard, A.S., 1924 Pleistocene Non-Marine Mollusca of England. Proc. Malac. Soc. London, vol. 16, pp. 84-97.
- Kennard, A.S. & Woodward, B.B., 1902 Post-Pliocene Non-Marine Mollusca of the South of England. Proc. Geol. Assoc., vol. 17, pp. 213-260.
- Kennard, A.S. & Woodward, B.B., 1917 Post-Pliocene Non-Marine Mollusca of Ireland. Proc. Geol. Assoc., vol. 28, pp. 109-19
- Kennard, A.S. & Woodward, B.B., 1922 Post-Pliocene Non-Marine Mollusca of the East of England. Proc. Geol. Assoc., vol. 33, pp. 104-142.
- Reid, C., 1890 Pliocene Deposits of Britain. Memoirs of the Geological Survey.

Reprinted: September, 1976.