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Precambrian microfossils of the British Isles

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Geological time spans with a very long roll-out chart showing the relative length of the Precambrian age. Even the best methods of dating geological time can only be accurate to about ±50 Ma, even in the late Precambrian.

During the Lower Cambrian, trilobites and shelly fossils were abundant but, as we travel back in time, other types of fossils were prevalent. Trace fossils, which show complex trails during the Cambrian, show less sophistication in the late Precambrian. Here organisms crawled along the surface or bedding planes, lack of energy or musculature prevented burrowing into the sediments.

Stromatolites too are typical of the upper Precambrian. These are constructed by mats of microorganisms, usually blue-green algae, which either precipitate carbonate around themselves or the organisms grow around incoming sediments. Large domes, some 0.75 m high are growing at the present time in Shark Bay, Western Australia, as well as smaller columns and flat layers in many other localities around the world. Precambrian stromatolites range in shape from single dome and laminations to branching or unbranching columns and in size from millimetres to tens of metres.

The Gunflint Iron Formation in Ontario, Canada, has famous stromatolite formations and here the first really convincing Early Precambrian microfossils were described.

Although most microbial mats have been described from stromatolites, they are just as common in shales. When studied carefully the laminations, composed of organic rich and sediment rich layers, can show a mixture of organisms present ranging from benthonic unicells and filaments to algal colonies and planktonic forms. Laminations from Torridonian shale show that in a single layer only 0.3 mm thick the top part is composed of filaments, the middle of ellipsoidal microfossils and the base of spheroidal organic microfossils.

The spheroidal organisms or sphaeromorphs, are worthy of study, some show similarity to eucaryotic cells. Thick-walled cysts are bound by thin-walled membranes which split, releasing the inner cysts. This can give the impression of three separate organisms, the whole, the open membrane and the cyst, and demonstrates one of the difficulties in interpretation of the fossil record. Degradation of these organisms and oxidation can also hamper identification.

Turning to the British Isles, near Carmarthen a newly discovered inlier of Cambrian and Precambrian sediment outcrops. Here simple trace fossils and medusoid impressions are predominant.

The Hartshill Formation at Nuneaton shows trilobites in the Stockingford Shale Formation and beneath this is a continuous cross-section through uppermost Precambrian shales which contain simple trace fossils and Tommotian faunas in the Home Farm member.

At Charnwood Forest in Leicestershire, in the Hallgate member of the Bradgate Formation, elements of the Ediacaran fauna can be found including the pennatulid - *Charnia masoni*, a leaf-like fossil, which appears to be attached to a circular structure, which was given the name of *Charniodiscus* when it was first discovered in isolation. These fossils can be compared with modern sea pens to give some idea of colonial organisation. Various medusoid impressions have also been found in the Charnian. However no microfossils have been discovered there in the whole sequence despite extensive searches.

In Anglesey, there is a unit called the Gwna melange and here there are enormous blocks of limestone which have tumbled down. These

contain various stromatolites which can be used to determine the original 'way up' of the blocks.

Further around the coast are possible trace fossils, but at Llanddwyn Island are pillow-lavas with small amounts of jasper between the pillows. These jaspers contain mineralised microfossils, microbial filaments and cells which have been encrusted or replaced by minerals. There is also evidence of small colonies of fine threaded fossils which are similar to *Metallogenium*, an iron bacterium.

On Islay, part of the largest area of Precambrian formations (incidentally an area with the least fossils) has stromatolites in dome and columnar formation. And the Torridonian of North Western Scotland contains algal mats and all sorts of microfossils, including many sphaeromorphs as well as colonial organisms and a unique sausage-like organism divided by a septum.

It can be demonstrated that some more modern contaminants can be interpreted as ancient fossils and in some cases up to 90% of items once described as fossils are actually more modern.

Finally there are the Longmyndian microfossils. These were first described by Salter in the 1850s and thought to be trace fossils, but which are now interpreted as rain or hail impressions or granular markings. Also, more modern interpretations of lineations being trace fossils are speculative as on the whole the markings are too big and regular to be fossils.

However, on one of Salter's slabs, Dr Peat has identified very fine sinuous ridges which he interprets as the linings of worm tubes - possibly similar in organisation to the modern *Tubifex*. John Pauley may have found medusoidal impressions and we must await his paper on this, and there are also some thick filaments and abundant algal mats as well as rarer sphaeromorphs.

There is thus great value of such research in terms of stratigraphy and evidence of evolution to biologists, and work by groups of amateur geologists who know their local rocks and can make detailed studies of small areas close to home.

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