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Microfossils in the Lower Cambrian

Dr. Martin Brazier[1]

BRAZIER, M. (1984). Microfossils in the Lower Cambrian. *Proceedings of the Shropshire Geological Society*, **4**, 15-17. There are thousands of metres of the Cambrian in parts of the world such as Siberia, Baltic, North America, but relatively few fossils. By contrast, the Cambrian in Britain is condensed and therefore very rich in fossils.

There is an identical succession in Nuneaton and Newfoundland, but a different succession occurs in Shropshire. In Shropshire the basal Cambrian rocks are not red as elsewhere - does this indicate that the arkosic succession has been faulted out? In fact, the Shropshire succession can be compared with that in Southern Sweden.

Cobbolds work in Shropshire identified six separate limestones in the lower Cambrian, each with different faunas. One of these, *Eodiscus bellimarginatus*, is a world marker of ocean swimming trilobites. Dr. Brazier has drawn up the first correlation between Nuneaton and Shropshire using fossils which shows that Shropshire is very good for the higher part, and Nuneaton for the lower part. Possibly a reasonable stratigraphy for the English Lower Cambrian could be established in these two areas, but this requires much more work in the Shropshire and Malvern sequences, particularly in the Lower Comley Sandstone.

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Research began with Lapworth 100 years ago, reaching a climax in the 1930's. No research has been done in Shropshire since then, or elsewhere, since 1960. However, Cobold demonstrated that it is quite possible for amateurs to make a valuable contribution.

Dr. Brazier sketched the paleogeographical setting of local Cambrian rocks and then went on to talk about the sequence of rocks in the Nuneaton area, which he has made a particular study of. This sequence is illustrative of what was happening during the Cambrian-and this was in turn related to events in Shropshire and elsewhere.

600 million years ago in the North Atlantic area, Scotland and Northern Ireland were closer to Greenland and Newfoundland, while France was much more remote. The Iapetus Ocean separated the North American continent, including Scotland, from the rest of Britain, which at that time was part of a small continent extending from New Brunswick through England and Wales to the Baltic. There is much controversy over this ocean, but it is generally thought to have been opening during the Cambrian and closing throughout the Ordovician and Silurian periods.

In Sweden, the Cambrian rocks sit on a thick sequence of granites and metamorphic rocks and comprise thin, shallow water sediments in mostly horizontal bedding; the "shales" are still "clays",' that is, uncompacted. This indicates a stable block area. Between Scandinavia and North America, an area of very slaty rocks, as found in Jura and Argyle, represent a deep sea trough on the edge of the Iapetus Ocean. In Scotland, the Torridonian and Lewisian rocks are horizontal, showing no folding or cleavage, and rest on a crystalline basement. Similar rocks can also be traced in North American. In contrast, in England and Wales, the Cambrian sits on volcanic deposits of the Uriconian and Charnian, suggesting an island arc situation. In the Wrekin quartzite are layers of clay derived from volcanic ash, supporting this theory.

In the Nuneaton/Charnwood area the succession compares very closely with the succession in Newfoundland. It starts with a thick series of volcanic sediments, usually greenish, slaty rocks. A 2 cm fossil similar to a trilobite has been found in these, and also in Russia and Australia. Frond type animal fossils are quite common in the Charnian, as are jelly fish type structures and worm trails - the most famous is *Charnia*. The Nuneaton succession shows evidence of a major rise in sea level together with a major diversification of animal groups. The Precambrian/Cambrian boundary is clearer there than in Shropshire. It shows a weathered volcano with successive beach deposits as sea level rose in the Cambrian. There is a succession of sandstone

of the same age as the Wrekin Quartzite. This is a shallow water sandstone with cross bedding and with many worm casts, similar to "*arenicular*", near the base. Other trace fossils on the bedding planes help to fix the date of the rocks. Typically these traces are circular feeding marks made by a type of worm and other worm marks, indicating a shallow intertidal area. As water deepens, wave energy decreases and more greenish clay minerals appear.

The *Hyolithes* Limestone in the Nuneaton Succession is the first appearance of shelled animals. The important feature is that in practically every outcrop of Lower Cambrian in Europe it has a different assemblage of fossils. This makes correlation difficult, including the placing of the Precambrian/Cambrian boundary, and indicates isolated communities. As the shoreline recedes, the deposits become muddier with trace fossils of trilobites. The bodies of trilobites appear later in the fossil record, possibly because, in their early stages of evolution, they were soft-bodied.

The *Hyolithes* Limestone is very similar to the Comley Limestone and lies above 2 metres thick glauconitic sandstone. The limestone is pinkish, sandy, with lots of glauconite, iron and many fossils of brachiopods and worms (also found in Ercall Quarry). Its base is very phosphatic, in small nodules, formed by faecal pellets. Higher up it is more homogeneous, formed by the sea floor hardening, then corroding. At the top the rock emerged above sea level, allowing the formation of algal mats. In the upper beds, there is an assemblage of molluscs, worms and sponges.

Some of the Cambrian fauna are still around today, e.g. *Lingula*, which has a calcium phosphate shell and the pre-trilobite fauna had phosphate skeletons. Most palaeontologists studying the Cambrian are convinced that there were many more phyla, which became extinct progressively through the Cambrian and Ordovician. Indeed, the Cambrian began with a major radiation of invertebrates which produce a much greater variety of body plan than we are familiar with. Many of these are yet to be named, including conodonts and early snails. Living Cambrian life forms such as primitive molluscs can be found in deep sea trenches. This diverse Cambrian fauna is known as the Tommotian assemblage (after Tommot, Siberia). The Cambrian therefore contains a very distinctive fauna, indeed some argue that the Cambrian should be considered a separate era in the same way as the Palaeozoic or the Mesozoic.

Just above the fossil horizon is a massive sandstone body, possibly representing shallow water conditions.

The succession is therefore: volcanoes broke into blocks by faulting; some thin limestones developed on some blocks and in the grabens thick successions of shales and sandstones developed - quartzites, glauconitic sands and muds, glauconitic limestones and shales.

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What of evolution in this period? In the Precambrian animals only crawled across the sea bed and did not dig into the stratum. At the Precambrian/Cambrian boundary, the majority of shelly fossils are found in the Cambrian and later. Skeletons are of wide variety, formed of silica, phosphates, calcareous or sand grains glued together. This was a period of a massive rise in sea level, with cyclic series of deepening then shallower water. The fossil record tends to show greater diversity when sea level is deeper and extinctions when the sea level drops. Thus, the greatest rise in sea level in the early Cambrian, produced a wide variety. Nearly all the creatures we are familiar with appeared around the Precambrian/ Cambrian boundary - brachiopods, sponges, worms, gastropods, bivalves, echinoderms, arthropods.

There are three interpretations of this "explosion" - the environment remained uniform and built up by mathematical progression; or the

degree to which creatures expand is constrained by the amount the environment expanded; or preservational overprint in which the environment of the late Precrambian was unsuitable to preserve many kinds of fossils and radiation started earlier, but the record is not preserved in the rocks.

A LECTURE BY DR MARTIN BRAZIER GIVEN TO THE SOCIETY ON 14th MARCH 1984

D.M. Jones

