become the Maori. Soon afterwards, a group of Maori colonised the Chatham islands, 800 km (500 miles) east of New Zealand. They became known as the Moriori. In 1835 Maori invaders with guns, axes and clubs invaded the Chathams, enslaving and killing most of the Moriori. The rest were largely wiped out over the succeeding few years by their Maori conquerors.

Interestingly, although they had, in common with the Maori, been an agricultural society, the Moriori had long since reverted to become hunter-gatherers. This made sense for them — the islands were too cold to grow the largely tropical Maori crops. Without being able to store surpluses of crop food, they *'could not support and feed nonhunting craft specialists, armies, bureaucrats and chiefs'.*[2] They were therefore an intrinsically less warlike society, which made them vulnerable to the Maori attack.

The lesson thus is that hunting-gathering is not a sign of being 'primitive' or 'less-evolved' but can be a means of coping with a particular situation in which people find themselves. In turn, the types of social structures and technologies relied upon by such cultures become appropriate to that situation.

In fact, hunting-gathering can be superior to agriculture in a given environment. Thus, the Norse farmers of Greenland were replaced by the Inuit (Eskimo) hunter-gatherers

> *'whose subsistence methods and technology were far superior to those of the Norse under Greenland conditions.'*[3]

Much of the evidence related to the so-called 'Stone Age' can be equally well understood as people dispersed into a harsh, uninhabited world, rapidly migrating in small groups. In particular, the cave-dwellers of the great post-Flood Biblical ice age can be seen as utilising highly appropriate living conditions and technology for survival in this difficult time.

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C. Wieland

Another Tropical Ice Age?

Uniformitarian geologists have worked out a scheme of four main ice ages from the mid Proterozoic to the late Palaeozoic. These 'ice ages' are based on till-like deposits and other supposedly diagnostic features that are found in many areas of the world (see Figure 1).

The late Proterozoic 'ice age' occurred between 950 and 550 million years ago in geological time. It is usually subdivided into three shorter 'ice ages'. Based on palaeomagnetism, this 'ice age' is claimed to have been laid down in the tropics![1] As a result, late Proterozoic tropical 'glaciation' is

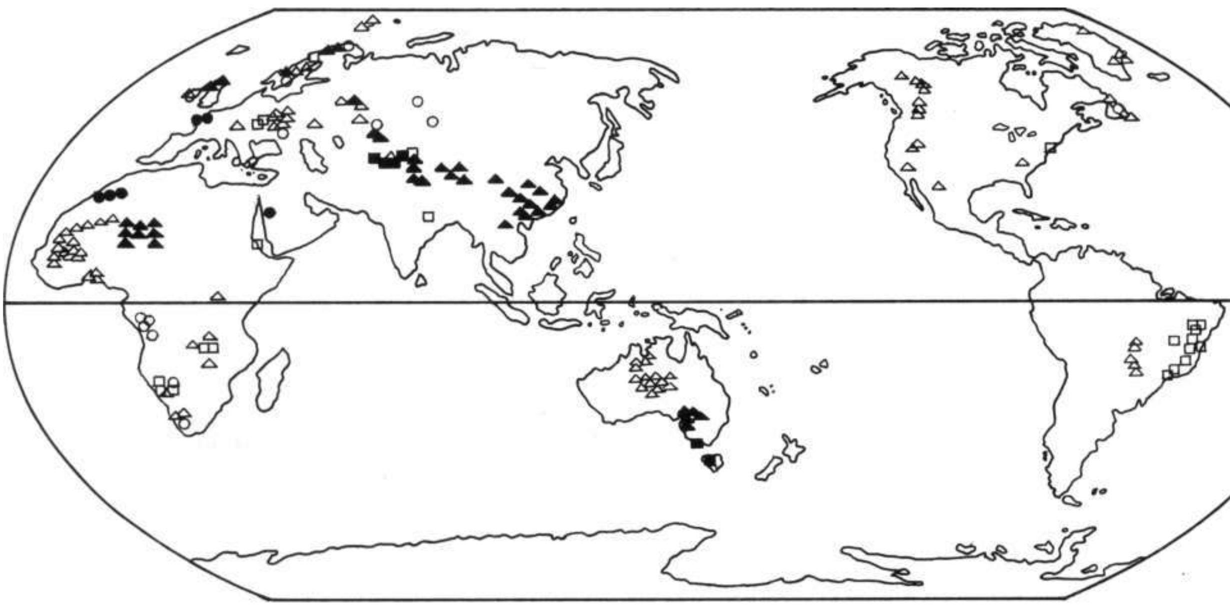

Figure 1. *Location of Late Precambrian till-like rocks of 'well-defined' age (filled-in symbols) and poorly-defined age (open symbols). Besides presumed glaciogenic rocks (triangles), rocks of uncertain origin (squares) and rocks of presumed non-glacial origin (circles) [once thought to be of glacial origin] are also included.*

one of the most enigmatic results of palaeoclimate:

> *'One of the most fundamental enigmas of the Earth's palaeoclimate concerns the temporal and spatial distributions of Precambrian glaciations'?*

Meert and van der Voo have challenged the tropical palaeolatitudes of late Proterozoic 'ice ages'.[3] They have suggested that many of the palaeomagnetic determinations failed to average the secular variation, the samples acquired a remanence during an excursion or reversal, and secondary magnetisations were identified as primary. Others have questioned Meert and van der Voo's claim and have produced newer palaeomagnetic results upholding the tropical palaeolatitude of at least one deposit.[4] This controversy does not inspire confidence in palaeomagnetic results.

The problem has now become even more enigmatic. New palaeomagnetic measurements on a mid Proterozoic till-like deposit from South Africa revealed a palaeolatitude location near the Equator.[5,6] Now, there are supposedly two tropical ice ages in the Proterozoic! The mid Proterozoic 'ice age', 2.2 to 2.5 billion years ago in geological time, is mainly represented by three diamictites along and north of Lake Huron in Ontario, Canada (see Figure 2). Several other till-like deposits from this time have been known from several other locations, including the well-preserved Makganyene diamictite of South Africa. It had been difficult finding the palaeolatitude of these diamictites due to regional metamorphism and multiple magnetic overprinting of the palaeomagnetism. Supposedly, this problem has been solved for the Makganyene diamictite, and the new measurements give a palaeolatitude of about 11° for associated lavas. Evans, Beukes, and Kirschvink conclude:

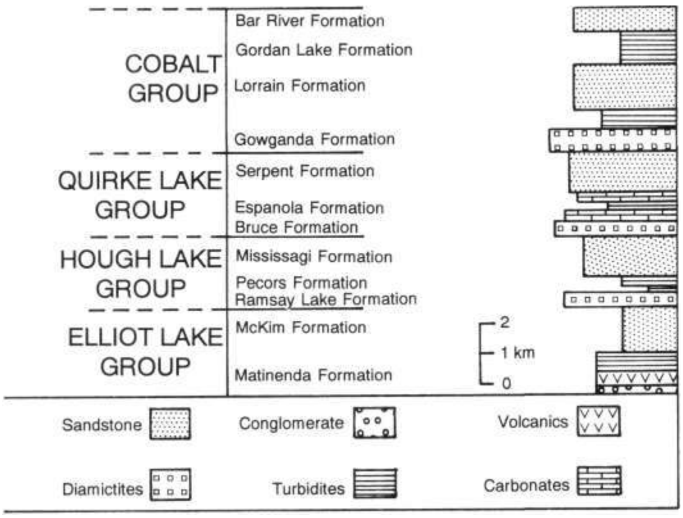

Figure 2. *The Huronian Supergroup, Canada, showing the context of the Gowganda Formation.*

> *'The palaeoclimate enigma is thus deepened; a largely ice-free Precambrian world was apparently punctuated by two long ice ages, both yielding glacial deposits well within tropical latitudes!*[1]

Not only did these ancient 'ice ages' supposedly cover tropical areas, but they occurred at sea level, since practically all pre-Pleistocene 'ice age' deposits are now recognised as glaciomarine. Williams claims that during the late Proterozoic equatorial temperatures at sea level averaged -12 to -20°C based on 'permafrost' features.[8] Furthermore, carbonates (including dolomites that require very warm water) are frequently associated with late Proterozoic 'ice ages'.[9] Even the mid Proterozoic 'ice age' is associated with carbonates. For instance, the carbonate-rich Espanola Formation (including beds of dolomite) lies between two 'tillites' in Ontario (see Figure 2).

Tropical 'ice ages' make it difficult to avoid the conclusion of a completely glaciated Earth twice during the Proterozoic. If the Earth ever became totally glaciated at any time, it is likely that the ice would never melt due to the high albedo of snow.[10,11] Budyko has suggested that the mean temperature of the Earth would plunge 100°C if the Earth ever became totally glaciated, even with the current solar luminosity.[12] Solar luminosity was supposedly 10 to 30 per cent less than at present during the Archaean and Proterozoic. Thus, the whole Earth would be locked in ice, unless some catastrophic event melted the ice:

> *'Only a catastrophic event, like a huge volcanic eruption, a comet or asteroid impact, the sudden release of methane hydrates, or the overturn of a deep stagnant ocean, could have pumped enough carbon dioxide back into the atmosphere to melt the planet's icy shell.'*[13]

These catastrophes still may not be enough to deglaciate the Earth. Uniformitarian scientists hope high carbon dioxide rescues them from the dilemma of a totally glaciated Earth. However, carbon dioxide is not that powerful as a greenhouse gas. The above catastrophic events would require around 1500 to 2500 times the present quantity of carbon dioxide to produce surface water temperatures in the liquid water range.[14]

What drastic measures uniformitarian scientists are forced to accept based on their belief that ancient diamictites were laid down by ice! Besides the till-like structure, the only other evidence the Makganyene diamictite was deposited from an ice sheet is striated and faceted clasts, some with several striation directions, supposedly diagnostic of an ice striated clast. However, it is well known that debris flows not only duplicate the till-like structure, but also duplicate the above features on clasts. I have observed them for myself in a debris flow that now lies more than 3,000 m high on top of the Gravelly Range of south-west Montana, USA.[15]

I thank Dr Robert Brown and Jon Covey for calling my attention to the new information.

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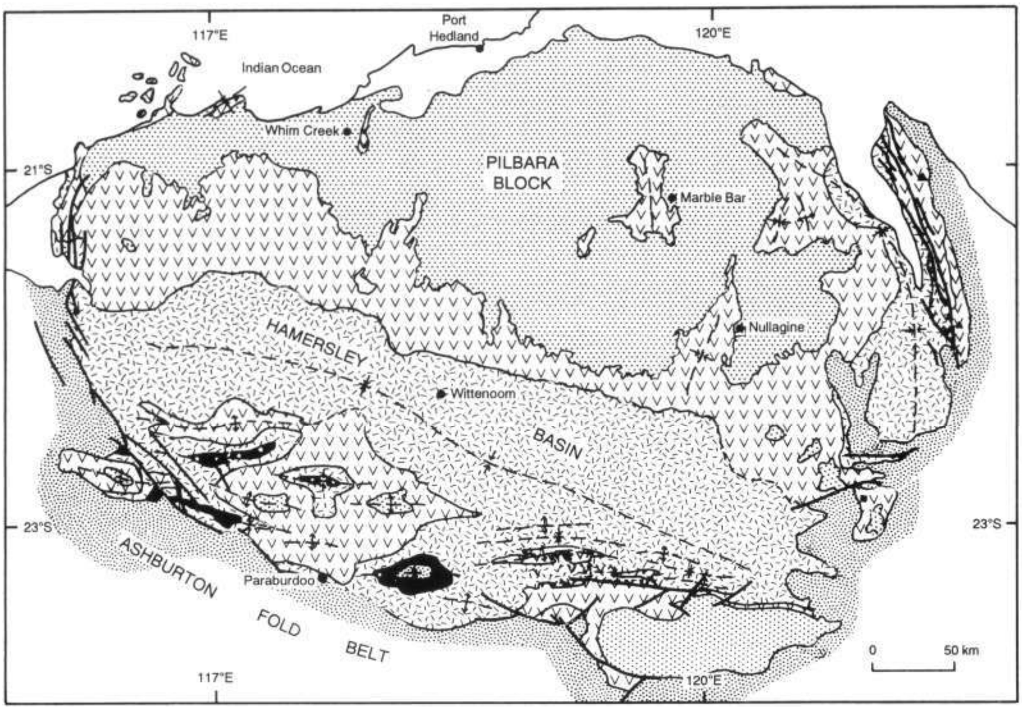
M. J. Oard

Could BIFs Be Caused by the Fountains of the Great Deep?

Banded-iron formations (BIFs) are thin rhythmites of iron-oxide and chert that are found in many areas of the world and dated as late Archaean and early Proterozoic according to the geological timescale. The origin of BIFs is a mystery with no modern analogue. Therefore, they must be explained by non-uniformitarian mechanisms. Two general theories have been suggested: from below or from above.[1] The 'from below' theory suggests BIFs were related to magmatic extrusions. The 'from above' theory is a typical uniformitarian model of very slow chemical deposition from upwelling ocean water over long periods of time. The alternations of iron-oxide and chert are presumably chemical varves, deposited seasonally in one year. The deposition rate supposedly would be around 3-4 m/Ma. The second theory has been favoured for its gradualistic appeal during a supposedly quiescent period of geologic time. BIFs have also been used as evidence for the slow build-up of oxygen in the Earth's early atmosphere.

It now appears that the 'from below' theory is the better explanation for BIFs. A recent analysis of the large Hamersley Province BIFs from central Western Australia indicates that BIFs were deposited during a major tectono-magmatic event, probably during the accompanying hydrothermal activity (see Figure 1).[2] These BIFs cover an area greater than 50,000 km^2 and can be thicker than 500 m (see Figure 2). They are now intimately associated with the submarine igneous province in the area that extruded a volume of rocks greater than 30,000 km^3.



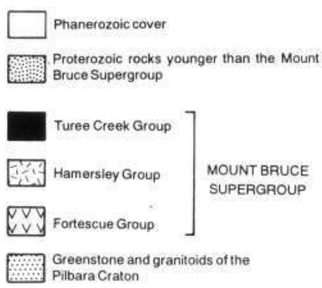


Figure 1. *Geological map of the Hamersley Basin (based on Geological Survey of Western Australia mapping).*