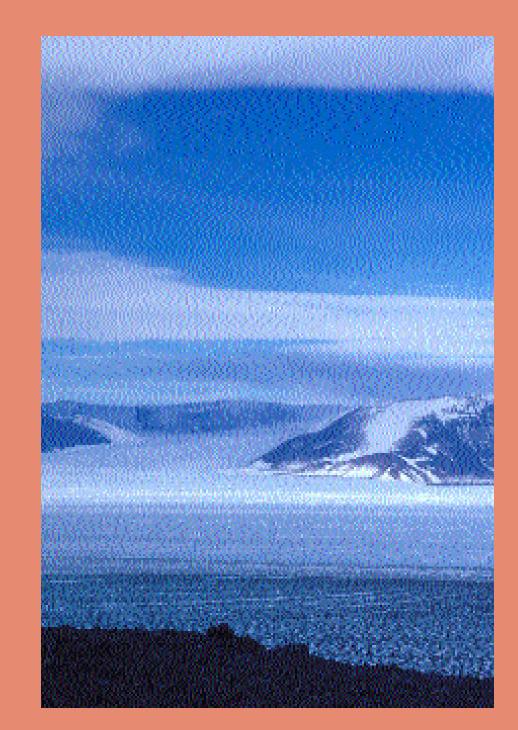
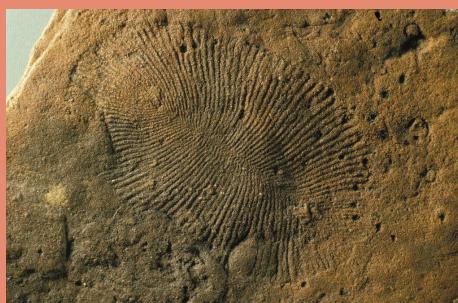


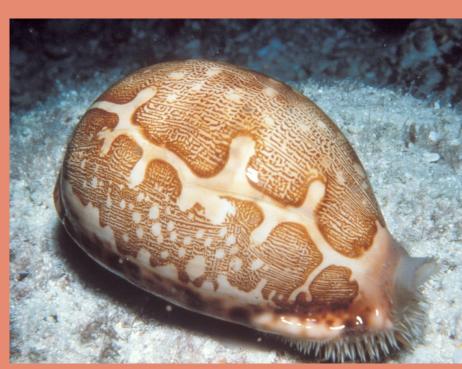
## Snowball Earth and an Explosion of Life

Climate and weather have an immense impact on life. This was especially true between 800 and 500 million years ago. The Earth during part of that time was in the grip of a massive glaciation, in fact several. At times, the whole Earth may have nearly frozen over – oceans and land – the theory proposing this is called "Snowball Earth." Such frigid conditions might have provided the Cool or Cold Cradle that gave rise to multicelled animals (metazoans) and then, as conditions warmed, led to the development of the first shells and skeletons.









From top to bottom: Snowball Earth - a time when the Earth nearly froze over, the last time being between 800 and 600 million years ago. (T. Rich)

Dickinsonia costata, probably some sort of annelid worm. It is about 6.5 cm long. (J. Gehling)

Mawsonites spriggi, a jellyfish-like animal about 8 cm in diameter.

( N. Pledge, courtesy of the South Australian Museum)

A living gastropod, a snail, with a hard, external shell. About 540 million years ago a great variety of animals developed hard shells.

Between 800 and 600 million years ago ice covered many parts of the Earth – much of the planet probably looked like Antarctica today – a time called "Snowball Earth." There was sea ice near the Equator. The whole Earth may have been locked up in ice – with only a few areas of open ocean.

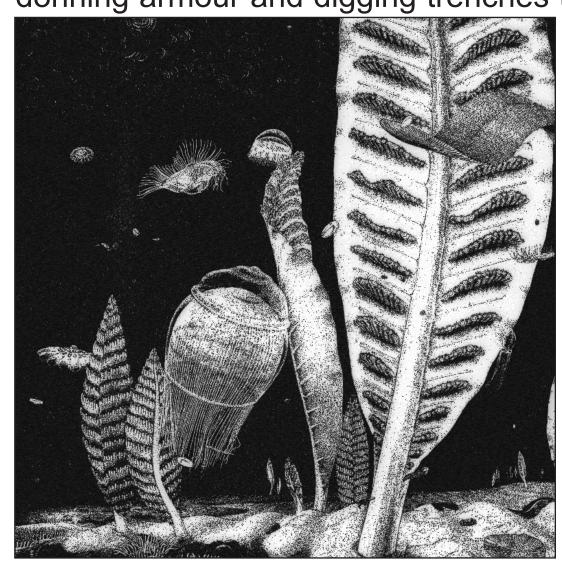
At the end of this period, things began to warm. As a parting shot, climate may have been the trigger for the formation of the hard parts that are so much a part of modern animal and some plant life – shells and skeletons. The intense cold itself may also have been the trigger for the rise of multicellular animals. Not all researchers agree on cold as the trigger for complexity, but one idea goes like this:

Complex life, which is evident in rocks of around 550-600 million years may have been "encouraged" by the increased oxygen that cold waters could hold – and the lower temperatures would not have been favourable to the bacteria that had dominated the seas before the glaciation.

The cold conditions may also have been the cause of the first shells and skeletons, hard parts being deposited by animals.. **How?** Australian palaeontologist John Shergold has suggested the following scenario:

- the surface waters of the oceans became supercooled when the Earth was a "Snowball Earth"
- -supercooled waters sank, as they were colder than the bottom waters of the oceans, and pushed up the ocean's bottom waters
- -bottom waters contained (as they do today) quantities of phosphate normally in short supply in the surface waters
- -phosphate is used by animals in a chemical reaction to produce energy for living, phosphous they extract from the algae they consume
- -and so, animals began to deposit this phosphorus (as a phosphate) to have a ready supply
- -deposited phosphate forms a hard substance called apatite and can make up shells and skeletons

We do know that many animals quite suddenly acquired skeletons about 540 million years ago. Our fossil record becomes fantastically rich at this time – from trilobites to clams. So, maybe Dr Shergold's idea is correct. Another event at this time was the development of eyes - and thus the development of predators with sight. This was another stimulus for the development of armor and the digging of burrows (the Verdun Syndrome - named after the WWI strategy of donning armour and digging trenches to survive enemy attacks).



Reconstruction of the Ediacara biota, animals that possibly developed with increasing oxygen in the cold waters, the "Cool or Cold Cradle" of animal evolution.

(Courtesy of Queensland Museum)