exoskeleton, is a risky task indeed. Some of these remains could conceivably turn out to belong to the shell or carapace of some unknown invertebrate animal. But, says Janvier,

> *'it is a risk worth taking in order to increase the probability of finding a clue to the still unresolved problem of the early evolution of the vertebrate skeleton.'*[3]

That's not the only problem for the evolutionary palaeontologists to solve. Accompanying Janvier's comments is a diagram showing the distribution of the major groups of living and fossil vertebrates through time, purporting to indicate the evolutionary lineages leading to today's vertebrates from an unknown common ancestor. Solid parallel lines for all the major groups signify the actual distribution. So how are all these major groups related on the evolutionary 'tree'? By dashed lines that mark inferred distribution and relationships *'according to one of the current theories'*, with a few question marks at joins! Is there any evidence shown of any of these inferred evolutionary links between the major groups? None, the links are still missing, as is the unknown common ancestor that is supposed to bridge the gap between invertebrates and vertebrates. It's time evolutionists were honest with the data — within major groups there has only ever been reproduction 'after their kind'. Furthermore, such tiny dermal fragments with their intricate structures once again display the Creator's handiwork and the wisdom of His many and varied designs to accomplish the same purpose — body housing and protection for the creatures He made.

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A. A. Snelling

Greenland Ice Cores Indicate Massive Ice Age Volcanism

Two ice cores about 3 km deep were drilled to the bottom of the Greenland Ice Sheet near Summit (see Figure 1). From the ice cores, many variables, such as oxygen isotopes, physical stratigraphy, and various ions, have been measured. A recent analysis of the sulphate (SO_4^{2-}) ion has shown that massive volcanism occurred during the ice age part of the ice sheet.[1]

The Greenland Ice Sheet formed during post-Flood times. It is probably impossible to develop an ice sheet during a global Flood, or that a pre-Flood ice sheet could survive such a cataclysm. Most of the Flood mechanisms proposed by creationists would generate copious amounts of heat, not cold. Thus, many creationists consider that there is a 'heat problem' with the Flood.

Based on oxygen isotope ratios, the top 1,500 m of the two cores are considered the Holocene, the last 10,000 years in the standard uniformitarian time-scale. The lower 1,500 m represent a 240,000 year period before the Holocene.[2] In the creationist paradigm, the pre-Holocene part of the core would have formed during the ice age and the Holocene part after the ice age.[3]

The SO_4^{2-} ion, deposited on top of the ice sheet, represents three sources:
(1) $CaSO_4$ from continental sources,
(2) SO_4^{2-} from the sea, and
(3) H_2SO_4 (sulphuric acid) from volcanism.

Sulphuric acid is formed in the atmosphere, mainly the stratosphere, due to explosive volcanism and the fire fountains from some basaltic eruptions.[4] The H_2SO_4 is mostly responsible for reflecting the sunlight back to space and cooling the lower atmosphere. For instance, the 1815 eruption of Tambora in Indonesia caused the 'year without a summer' in 1816 in at least New England and Europe.[5] Previous analyses of the volcanic signal in the ice cores had relied on acidity calculations, produced by measuring the down-core electrical conductivity.[6] However, this method crudely reproduces the volcanic input because of the presence of other acids that are poorly correlated to volcanism.

The volcanic SO_4^{-2} ion was separated from the other ionic inputs by the method of empirical orthogonal functions.[7] The empirical eigenvectors for the volcanic signal were matched with the better resolved volcanic signal of the past 2,000 years.[8,9] In estimating the magnitude of the eruptions from the

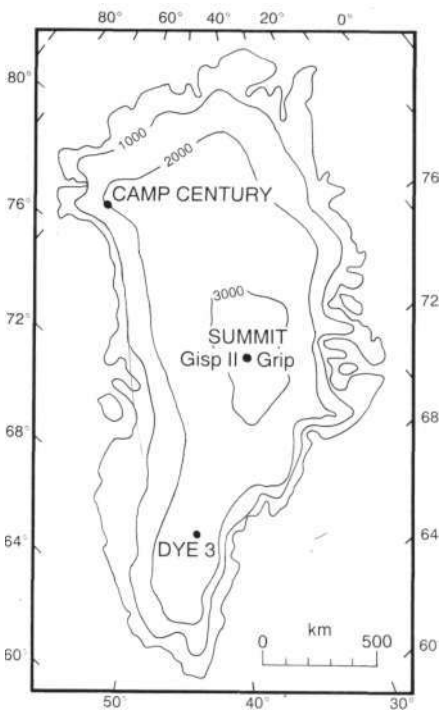

Figure 1. *Location of the Summit ice cores* ***GRIP*** *and* ***GISP2*** *in central Greenland.*

ice-core signal, the latitude of the presumed eruption was taken into account as well as the likelihood the core signal overestimates the stratospheric aerosol loading. The core signal matches the volcanic chronology, developed from independent sources, to about AD 700. A previously claimed match of about 30 per cent to volcanic events from 1 BC to 7000 BC[10] was shown to be in error because the researchers did not use dendrochronology-corrected carbon-14 dates for the non-core volcanic chronology.[11,12] The difference between carbon-14 dates and calendar year dates supposedly amounts to 800 years older than 3000 BC, and 100 to 150 years from AD 100 to 700. The correlation of volcanic time series needs at least a 3-year resolution.

From the above empirical orthogonal functions and the good match with known large volcanic eruptions of the past 1,300 years, many eruptions during the ice age portion of the core were discovered:

> *'We identified ~850 volcanic signals (700 of these from 110,000 to 9,000 yr ago) with sulfate concentrations greater than that associated with historical eruptions from either equatorial or mid-latitude regions that are known to have perturbed global or Northern Hemisphere climate, respectively. This number is a minimum . . .'*[13]

The number of eruptions is considered a minimum because of the coarse sampling of the core. Seven hundred volcanic eruptions greater than historical eruptions over a 100,000 year period is not expected to perturb the climate on scales more than a few years. However, telescoping the uniformitarian time-scale for the 110,000 to 9,000 year period into a span of 500 years or so, according to the method of Vardiman,[14] results in an ice-core signal of massive volcanism during a post-Flood ice age. In the compressed creationist time-scale, some of these 700 volcanic events probably were the same event. Regardless, one of the potent mechanisms for a rapid ice age after the Flood (the other mechanism being warm ocean water at mid and high latitudes)[15] has probably been empirically verified.

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M. J. Oard

The Trouble with Teeth

Shark researchers have found that sharks, which shed their teeth throughout their lives, begin shedding them *in utero.*[1] Michael Gottfried of the Calvert Marine Museum in Solomons, Maryland, U.S.A and Malcolm Francis of the National Institute of Water and Atmospheric Research in Wellington, New Zealand, studied a pregnant female great white shark. They found teeth in both the mother's uterus, as well as in the stomach of the 1.2 metre long baby Many of these teeth were quite different to adult great white shark teeth. Many were small, conical and not serrated, whereas adult teeth are large, flat, triangular and serrated. Interestingly, the embryonic teeth of the great white shark look virtually identical to the adult teeth of a sand-tiger shark, a species classified in an entirely different family.

Palaeontologists have used teeth alone to identify many fossil sharks. Often only teeth have been found. Shark's teeth vary greatly, depending on where they are in the jaw. The discovery of embryonic teeth adds another dimension of confusion and raises the question of how many spurious fossil shark species have been named, based on embryonic teeth, and how much evolutionary speculation has been based on such teeth.

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