L7 The oldest rocks of the Archean < fubarites >

It remains that, from the same principles, I now demonstrate the frame of the system of the world.
—Isaac Newton.[1]

What evidence is there of the very earliest Archean continental cratons? [2] In other words, what is oldest radiometric date of Archean supracrustal (deposited upon continental granitic basement) rocks.

So far, the oldest discovered is Early Archean 3.7-3.8 Gy Isua supracrustal sequence in southwestern Greenland (near lat. 65°N, long. 51°W).[3] The sequence is mostly "volcanics" (thick basaltic pillow lavas with intercalated beds of ironformation (Algoman BIF), chert, and quartzo-feldspathic schists) and some "sediments" (sedimentary conglomerates, pelitic metasediments, and garnet amphibolites). These are not of great extent where they crop out and to recognize them the field is not straightforward because they are highly deformed and much altered by metamorphism. The less than reverential field geologist's descriptive term for them is "fubaritic" (fouled up beyond all recognition, or similar sanguinary words). Even so, Appel, Fedo, Moorbath and Myers in 1998 described several low-strain domains where, in the volcanics, can be seen cooling rims on pillow lavas and pipe vesicles showing facing-directions in pillow sequences.[4] In the vesicles, unstrained quartz crystals contain small cavities with fluid inclusions. Likened by their mode of occurrence to similar in some present-day seafloor hydrothermal alteration systems, these fluid inclusions can be samples of, and yield compositions of, primordial water and gases.

3.8 Gy orthogneiss (gneiss formed from granitic plutonic rock) is known from: the Northwest Territories, Canada; Minnesota, USA; and, South Africa. Obducted 3.8 Gy mantle rock is described from gneisses exposed along the present coast of Labrador, Nain structural province, Canada.

The oldest continental rock found so far is 3.96 Gy Acasta gneiss (age of zircons crystallized in it), found east of Great Bear Lake in the Slave structural province, Canada. An even older "record holder" can be anticipated as in some sandstones (Jack Hills, Western Australia), 4.4 Gy detrital zircons have been found.[5] ❑

Figure L6.2 [6] Early Archean oceanic crust produced at mid-ocean ridges should be high in MgO, because of hotter-than-now mantle melts, but of low density for their composition when solidified, because of hydration. As this crust would be unable to subduct, intraoceanic convergences would have been sites of continuous imbrication (thrust stacking of layers). Archean sodium-rich granitoids in high-grade metamorphic "gray gneiss" belts and in low-grade granite-greenstone terrains are tonalite (quartz diorite), trondhjemite (granodiorite with no K-feldspar), and granodiorite. Robert P. Rapp, Nobumichi Shimizu, and Marc D. Norman in 2003 provide experimental evidence that this "TTG suite" can be accounted for by the partial melting of hydrous basalt in the eclogite facies as would have existed beneath imbricate granite-greenstone complexes.[7]