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Comment on "A Vestige of Earth's Oldest Ophiolite"

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Furnes *et al.* (Reports, 23 March 2007, p. 1704) reported the identification of an ophiolite sequence within the ~3.8-billion-year-old Isua supracrustal belt. However, they did not acknowledge that the belt contains supracrustal rocks and mafic dikes of different ages, nor did they demonstrate that the proposed components of the ophiolite are coeval.

Furnes *et al.* (1) reported that a sheeted-dike complex they identified within the ~3.8-billion-year-old Isua supracrustal belt (ISB) in Greenland provides the oldest evidence of oceanic crustal accretion by spreading. However, they did not alert readers that the ISB contains supracrustal rocks and mafic dikes of different ages (2, 3). They also failed to demonstrate that the proposed components for their ophiolite are coeval. These are important oversights, because a genuine ophiolite is a coeval assemblage of gabbros, sheeted dikes, and pillow lavas [e.g., (4)].

At Isua, the copious Paleoproterozoic Aeralik dyke swarms cut all Eoarchean rocks, including all components of the 3.81 to 3.63 Ga orthogneisses (Fig. 1) that envelop the ISB (5). Within the ISB, the Aeralik dikes are variably deformed and largely recrystallized into amphibolites (6). Remarkably, Furnes *et al.* (1) did not even mention that these dikes exist when discussing the origin of their "sheeted dikes." In the area covering localities 2 and 3 in (1), detailed mapping (Fig. 2) shows that there are numerous amphibolite dikes of differing thickness that are aligned subconcordantly to the lithological layering of the host volcano-sedimentary rocks. Dikes occur not only in the metavolcanic amphibolites as described in (1), but also in siliceous metasediments, ultramafic rocks, and the petrogenetically unrelated "boninitic" amphibolites to the west. As these dikes cut a wide range of unrelated lithologies, they cannot all represent a simple "sheeted dike" complex as proposed. Furthermore, in geochemical diagrams [Fig. 3 in (1)], the data presented show that their dikes are less evolved than the material they are supposed to feed. This is contrary to the suggestion that the pillows and sheeted dikes are related. Thus, Furnes *et al.* (1) need to show that they have distinguished dikes that are younger, unrelated intrusions such as (<3.5 Ga) Aeralik dikes and ones that might really form an earlier sheeted complex.

Furnes *et al.* stated that traversing northwards from their localities 3 to 1 entails passing stratigraphically upwards from sheeted dikes to pillows [figure 2A in (1)]. Thus, pillows at their locality 1 should be facing northward. Our photograph of the same pillows (Fig. 3) shows that they actually face southward, opposite to the sense that is required for their proposed simple stratigraphic relationship. Therefore the struc-

tural relationships cannot be as simple as suggested in (1).

Furnes *et al.* did not explicitly inform their readers that the Isua supracrustal belt contains fragments of both 3.7 and 3.8 Ga volcano-sedimentary sequences (2, 7). Thus, the metachert unit that crops out beside their localities 1 to 3 (Figs. 1 and 2) contains rare ~3.7 Ga volcano-sedimentary zircons (7), suggesting the maximum age of this package as ~3.7 Ga. However, in the southwest of the belt, where Furnes *et al.* (1) proposed that there are coeval ophiolitic gabbroic protoliths, amphibolites are cut by ~3.8-Ga tonalite sheets, giving their minimum age as ~3.8 Ga (2, 7, 8). Have Furnes *et al.* equated ~3.8 Ga metagabbros with ~3.7 Ga metavolcanic rocks and perhaps some still younger dikes? More exacting evidence is required to turn "Earth's oldest ophiolite" from an exciting proposition into an established fact.

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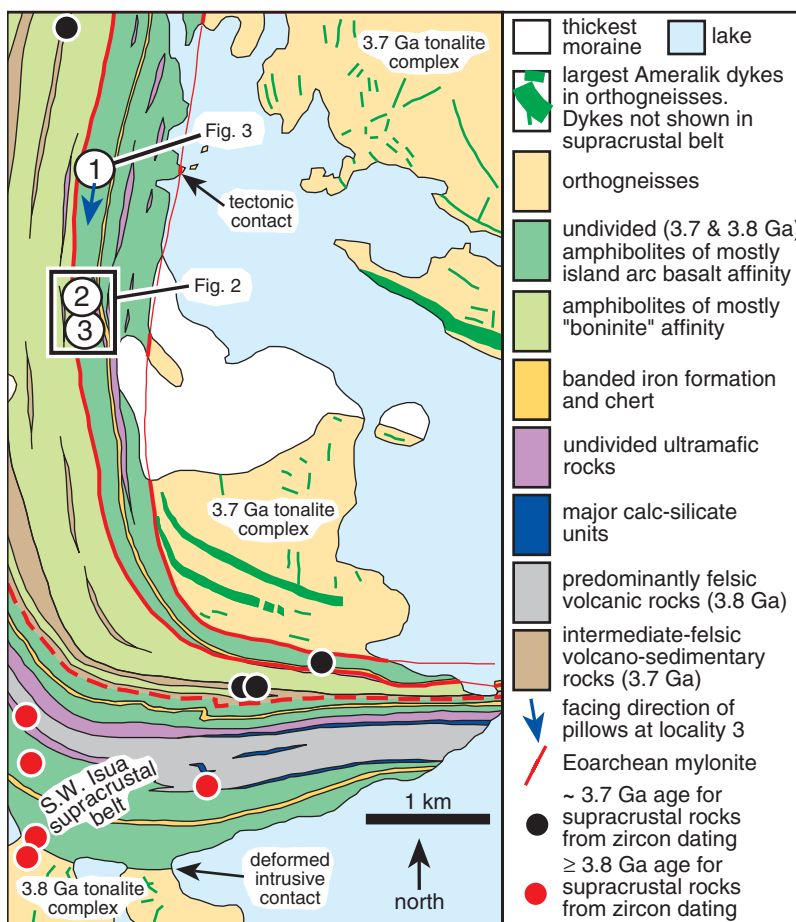


Fig. 1. Geological sketch map of part of the western end of the Isua supracrustal belt. Only the thickest, most continuous areas of cover moraine are shown. Mapping compiled from (6, 7). Zircon dating results constraining the ages of supracrustal rocks in the southwest to ≥ 3.8 Ga and in the northeast to ≤ 3.7 Ga are shown. The localities 1, 2, and 3 are from (1). The belt is partitioned by Eoarchean shear zones. The likely position of the break between the ~3.8 and 3.7 Ga sequences is presently known only within 200 m (7).

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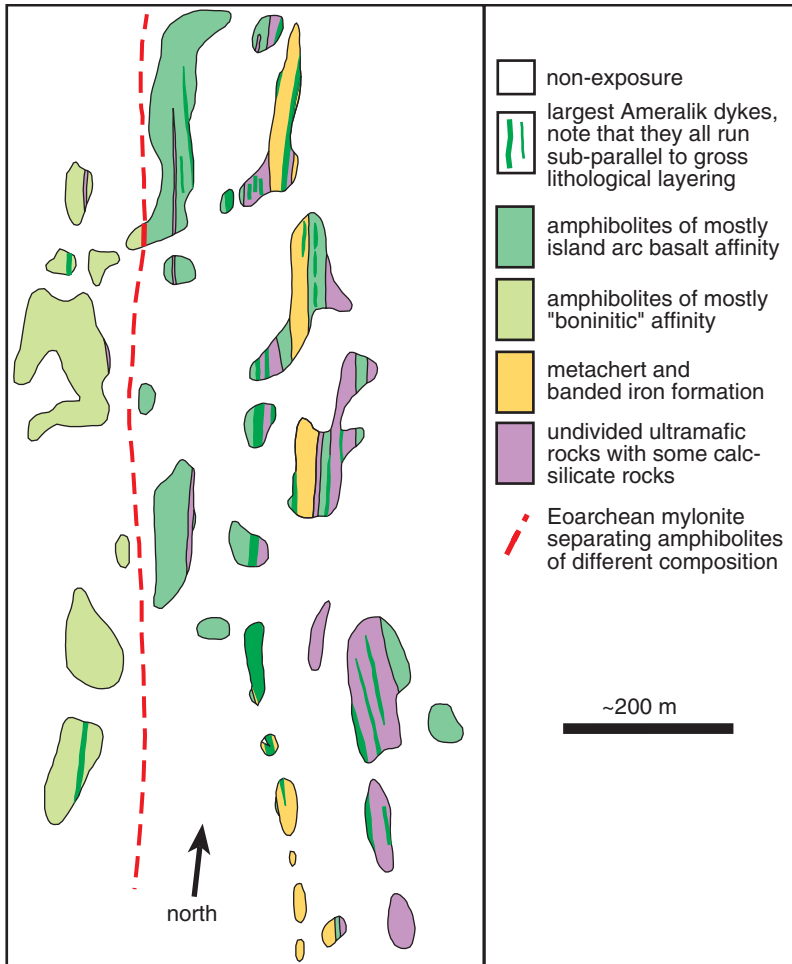


Fig. 2. About 1:10,000 scale mapping by A. P. Nutman in August 1980 of the area thought to cover the Furnes *et al.* localities 2 and 3, by using their low-resolution sketch map [figure 1C in (1)]. Numerous amphibolitized dikes cut all lithologies and are oriented subconcordant to the lithological layering.

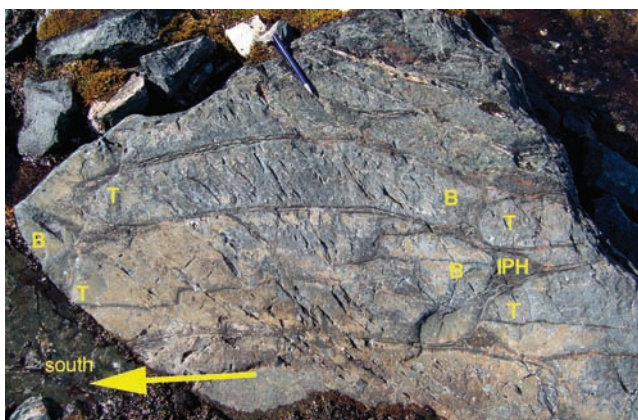


Fig. 3. Pillow lavas at Furnes *et al.* locality 1. The shape of the pillows indicates facing to the south (left of picture), and hence toward the proposed sheeted dikes. IPH is the interpillow hyaloclastite shown by Furnes *et al.*; T and B are the top and base, respectively, of some pillows. The pillows have been flattened orthogonal to their original orientation. [Photo by A. P. Nutman]

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