

Lower crustal process; magmatic input, reequilibration and reformation in the Kohistan arc, northern Pakistan

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The Kohistan block in northern Pakistan represents an exposed crustal cross section to near-MOHO depths of an ancient island arc which became sandwiched between the Eurasian and Indian continents. The Kohistan block is tilted to the north due to uplift by subduction of the Indian continent from the south.

The Kohistan lower crust is composed of three geological units: Jijal complex (dunite/wherlite, garnet clinopyroxenite and garnet granulite), Kamila amphibolite (banded amphibolite partly strongly sheared) and Chilas complex (pyroxene granulite derived from gabbro-norite with dunite and gabbro blocks) from lower to upper structural levels. These units are geologically continuous, with no major tectonic breaks between them.

Geological and petrological observation suggests the history of the lower crustal mafic rocks of Kohistan is summarized as

(1)Gabbro(-norite) --- (2)Pyroxene (or garnet) granulite --- (3)Amphibolite

It is a process of re-equilibration and reformation into the lower crustal material starting from an original magmatic input. The various stages of the rocks are exposed in each unit; (2) with locally (3) in the Jijal complex, (3) with minor (2) in the Kamila amphibolite, and (2) with locally (1) and (3) in the Chilas complex.

The huge size, up to 80km x 300km of these mafic units cannot be a single magma chamber in the crust. They would have formed by successive injections of mafic magma over a considerable area and a period of time. Considerable scatters of isotopic age data on these rocks so far documented might be due in part to variation in the quality of the data, but some of the scatter might also reflect a differential progress of the lower crustal process including protracted emplacement and cooling history for these rocks.