

Paper Number: 2838

Ar/Ar ages from the Shergol blueschist unit, Indus suture zone, Ladakh: preservation of early stages of subduction of the Neotethys

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The Shergol blueschist unit [1, 2] of the Indus Suture Zone in Ladakh is one of only few HP/LT units that occur along the whole Himalayan orogenic belt. It is located between the Ladakh block, a Cretaceous to early Tertiary arc-island arc sequence in the north and the Lamayuru Group, Mid-Jurassic to Santonian sediments and volcanics of the Indian passive margin [3] in the south and belongs to the south Lakakh intraoceanic arc [2]. The blueschists and corresponding rocks of the Indus Suture mélange are discordantly overlain by siltstones to conglomerates of the Shergol Conglomerate Fm. After continent-continent collision, this whole nappe stack, initially assembled by southward thrusting, is backthrust to the north, including the Shergol Conglomerate Fm.

The blueschist unit consists mainly of basic volcanic and pyroclastic rocks, and some meta-sedimentary rocks, quartzites, cherts and impure marbles. These rocks are generally only weakly deformed, preserving volcano-sedimentary textures, often. The foliations in deformed rocks and shear zones, defined by Na-Ca-amphiboles, chlorite and phengite, are often overgrown by late lawsonite, indicating that they formed on the burial path. Mineral parageneses (albite-lawsonite-glaucophane-Na-pyroxene-phengite-garnet-quartz) allow to constrain the metamorphic conditions at about 400-440°C and 10.5-12.5 kbar based on the petrogenetic grid of Will et al. [4]. These P-T conditions are in agreement with geothermobarometric investigations (garnet-phengite, phengite barometry). Part of the prograde, compressional path is recorded in mineral zonations and their order of crystallisation, but no retrogression of the HP-parageneses is discernible.

Ar/Ar dating of white micas from the blueschists, the Lamayuru Group and the Shergol Conglomerate Fm. allows to constrain the timing of several events along the Indus suture zone. Well-crystallised phengites (sizes of ca. 0.5 mm) of three blueschist samples yielded ages of 114, 120, and 121 Ma, respectively, with no or negligible loss of Ar. Single and multiple grain analyses of phengites from one and the same sample gave excellently reproducible results. More fine-grained phengites yielded plateau ages of 117, 115, and 109 Ma, but initial release ages of about 70 to 80 Ma, pointing to a later overprint. Detrital white micas from the Shergol Conglomerate Fm. display several distinct age groups with the youngest age group from about 37 to 55 Ma, an age group from 65 to 85 Ma and ages in the range from ca. 125 to 535 Ma. Muscovites from the Lamayuru Group, from ca. 100 km farther to the E (Zaskar river section), gave an age of ca. 34 Ma.

The age data from the blueschists are formation ages, as metamorphic temperatures correspond to the blocking temperature of phengite. They thus prove mid-Cretaceous (Aptian) subduction in the Neotethyan domain. This age is about the same as that of the oldest subduction-related magmatic rocks of the arc-sequence north of the Indus suture zone corresponds to the time India set out for its journey from Gondwana towards Asia. The overprint ages and the age group of detrital micas of about 65-85 Ma record a second distinct event that should still be related to subduction of the Neotethyan Ocean. The age group of 37 to 55 Ma of detrital white micas is similar to detrital ages of the Indus Group [5] and

could relate to the exhumation of Indian continental crust just south of the Indus Suture Zone. The youngest ages (ca. 37 Ma) place a maximum age on deposition of the Shergol Conglomerate Fm. and hence the timing of backthrusting along the Indus Suture Zone.

References:

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