U-Pb Determinations and Tectonic History in the Kali Gandaki Region (Annapurna Himal, West-Central Nepal)

TALK

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The Main Central Thrust (MCT) is a crustal scale, ductile-brittle shear zone that spans the contact between the Greater Himalayan metamorphic sequence (GHMS) and the underlying Lesser Himalayan sedimentary sequence (LHSS). The GHMS is separated from the overlying Tibetan sedimentary sequence (TSS) by the Annapurna detachment fault (ADF). The MCT and ADF have been studied in detail along the Kali Gandaki - Ghaleti Khola near Dana and in a drainage west of Dhumpu, respectively.

Within the MCT shear zone, three phases of ductile deformation are observed in GHMS lithologies: D1 structures are isoclinal folds outlined by compositional layering and an S1 foliation preserved as inclusion trails in garnet; D2 structures are the product of southwesterly directed progressive deformation at kyanite grade and consist of a pervasive foliation (S2), a down dip stretching lineation, tight to isoclinal folds and shearing fabrics, all of which have been subsequently deformed by southwesterly verging folds and crenulations; D3 locally formed chlorite-grade mylonite shears near the base of the GHMS. In the LHSS four ductile deformation events, with characteristics similar to those in the GHMS, are overprinted by a fifth phase of brittle deformation.

The effects of ductile shearing on the MCT are most pronounced in the pelitic gneiss unit of the GHMS where the dominant fabric is very planar, gneisses are medium grained, and the hinge lines of D1 and D2 folds are oriented parallel to down dip stretching lineations. Associated with ductile shearing in the hanging wall of the MCT is a strain gradient. This is demonstrated by the rotation of D1 and D2 hinge lines from a down dip orientation near the base to nearly horizontal in the more central portion of the GHMS; there is also an upwards coarsening of gneisses, fabrics are less planar, and the angle between S1 and S2 increases. Abundant top-to-the-southwest shear sense indicators related to movement on the MCT are observed, but well developed mylonites either did not form or are obscured by the extensive recrystallization found in the GHMS. These annealed fabrics formed at middle crustal conditions and suggest a period of static recrystallization prior to exhumation and reactivation of the basal shear zone at upper crustal levels. Similarly, the ADF is characterized by recrystallized leucogranites with top-to-the-northeast normal sense ductile shear fabrics which are superimposed by a discrete zone of brittle deformation.

Single and multi-grain fractions of monazite and thorite from two igneous rocks within the GHMS have been dated using the U-Pb isotope system. An undeformed, coarse grained pegmatite, which cuts across S2 in the highly strained pelitic gneiss unit within the MCT shear zone, has an interpreted crystallization age of 21.8 +/- 0.5 Ma. Above the high strain of the MCT shear zone, a

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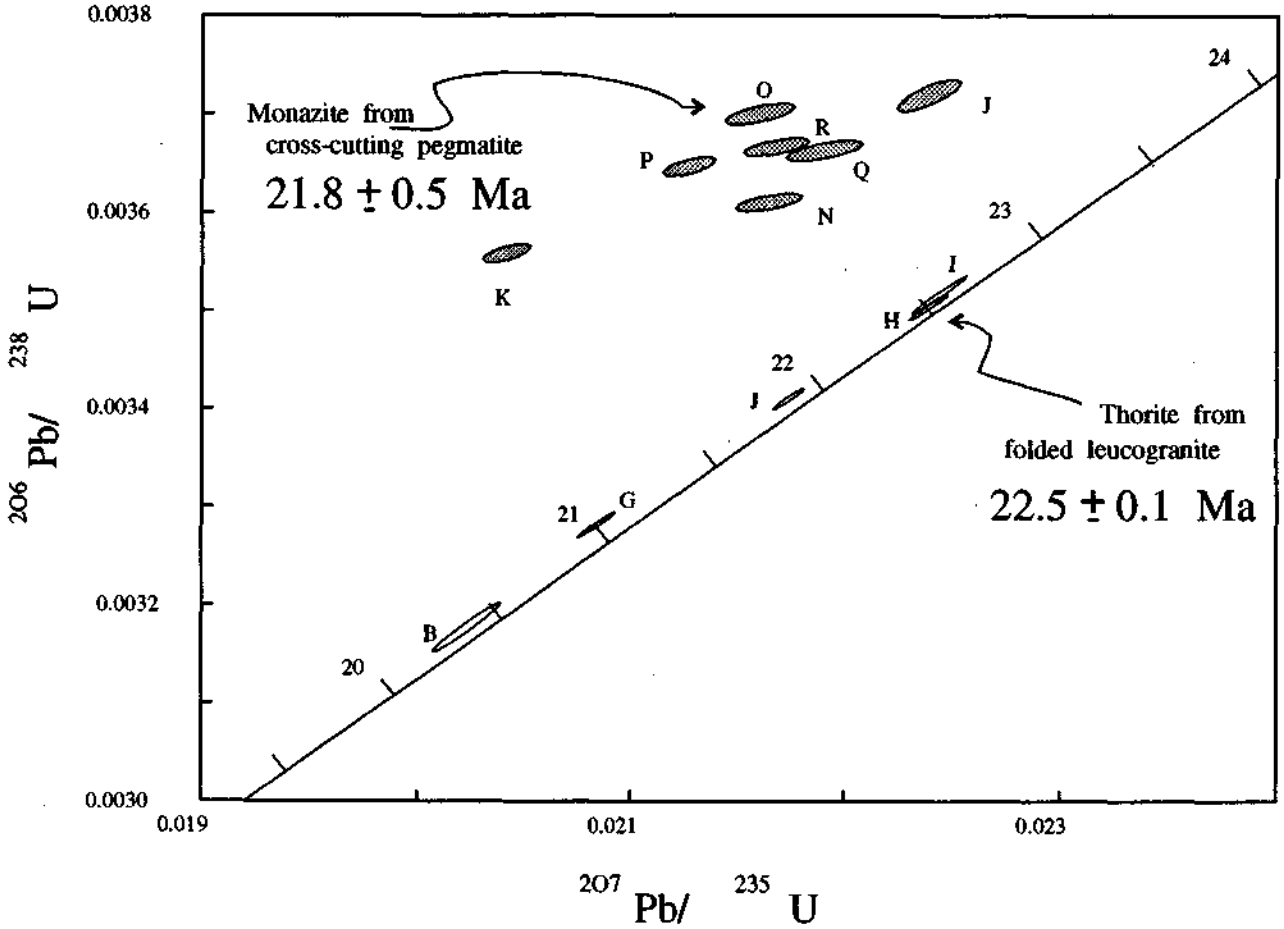

multiply deformed leucogranite body in the calc-silicate gneiss unit which exhibits interference patterns between D1 and D2 folds and contains the S2 foliation has an interpreted crystallization age of 22.5 +/- 0.1 Ma.

The new structural and U-Pb data presented here imply the following temporal relationships in the Kali Gandaki region: 1) peak metamorphism, anatectic melting, and leucogranite emplacement occurred at about 22.5 Ma; 2) at least some of the D1 deformation and all of the D2 deformation associated with the MCT occurred between 21.8 and 22.5 Ma, and therefore, both deformation events are Himalayan in age; 3) ductile deformation on the ADF probably happened after 22.5 Ma; 4) at 21.8 Ma ductile deformation on the MCT and possibly on the ADF had ceased, followed by a period of extensive static recrystallization as the GHMS cooled; 5) a subsequent pulse of movement formed chlorite-grade shears in the GHMS and a biotite-grade crenulation in the LHSS; and 6) more recently, reactivation of both the MCT and ADF has superimposed brittle fabrics on ductile shear fabrics.

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