

APPENDIX A

GEOLOGICAL SUMMARY OF PLATE 1

Late Triassic to Tertiary age Indian passive margin rocks are present along the line of the INDEPTH II line. In the northern most part of the section are >10 km (structural thickness) of micaceous sand-, silt-, and mudstones interlayered with greywackes, probably Triassic. These are thrust over ~30 km (imbricated structural thickness) of Jurassic/Cretaceous crenulated black shales and interlayered (from folding and thrusting) with pale calcareous shales, and local sandy calcareous shales. These pass southwards to a general flysch sequence (~8 km of structural thickness) of shales interlayered with sands and greywackes. These are in turn, thrust over (late Triassic?) >10 km thick brown and orange shales with prominent quartzite layers

A ~25x30 km dome exposes dark phyllites at the Karo La massif (Noijingkang - 7191m), immediately W. of Yamdrock Tso. The phyllites are >2km thick, lying structurally below the Triassic and younger Tethyan sedimentary rocks, which are affected by regionally W-E trending, north-dipping, south-vergent folds & thrusts. Kinematic fabric of foliation-parallel quartz veins/sheets, and mineral stretching lineations constrain clear top-to-north displacement upon discrete horizons within, and at the top of, the phyllite unit. In addition, mapping & TM interpretation show that the regional W-E fabric terminates and soles into the phyllite unit upon the N, S, & E sides of the dome. Despite the clear top-to-north sense of shear, we infer that much of the strain within the phyllites was accumulated during "thin-skinned" south-directed fold & thrusting of the Tethyan sequences, and that the phyllite layer has acted as a decollement horizon; the Karo La decollement (KLD), that has enjoyed both north- & south-directed hangingwall displacement. The updoming of the phyllite and the conditions for quartz veins & new mineral growth are likely related to the emplacement of a large leucogranite (the Karo La granite) that is exposed in several places in the core of the dome. The leucogranite intrudes (cross-

cuts) the phyllite, and may provide a minimum age for displacement on the KLD.

The Karo La dome is cut by a major graben-bounding N-S normal fault (part of the Yadong-Gulu rift system - YGRS). New apatite fission track data from the Karo La granite give an age of 4.7 ± 1 Ma, and prior geochronology (Copeland, 1990) gives $^{40}\text{Ar}/^{39}\text{Ar}$ cooling ages of 10.5 ± 0.1 & 10.9 ± 0.1 , respectively. These ages imply exhumation of this segment of the YGRS hanging wall between ~ 10 & 5 Ma, consistent with general opening of the YGRS at this time (e.g. Nyainqentanglha). We have mapped similar phyllite decollement layers in (e.g.) northern Nieru, and as part of two other nearby domes (Kangmar, & Mangda Kangri), and we suggest that the phyllite marks a regional, originally N-dipping extensional surface.

Alternatively, the association of the top-to-north fabric with plutonism could indicate that (1) the Karo La pluton was emplaced in an extensional setting, or (2) immediately before freezing, magma was transported south relative to the overlying KLD, the phyllites having acted as a horizontal barrier to block magma ascent.