The Karo-la Decollement, southern Tibet

a Himalayan extensional structure domed by emplacement of the Late Miocene Karo-La Granite

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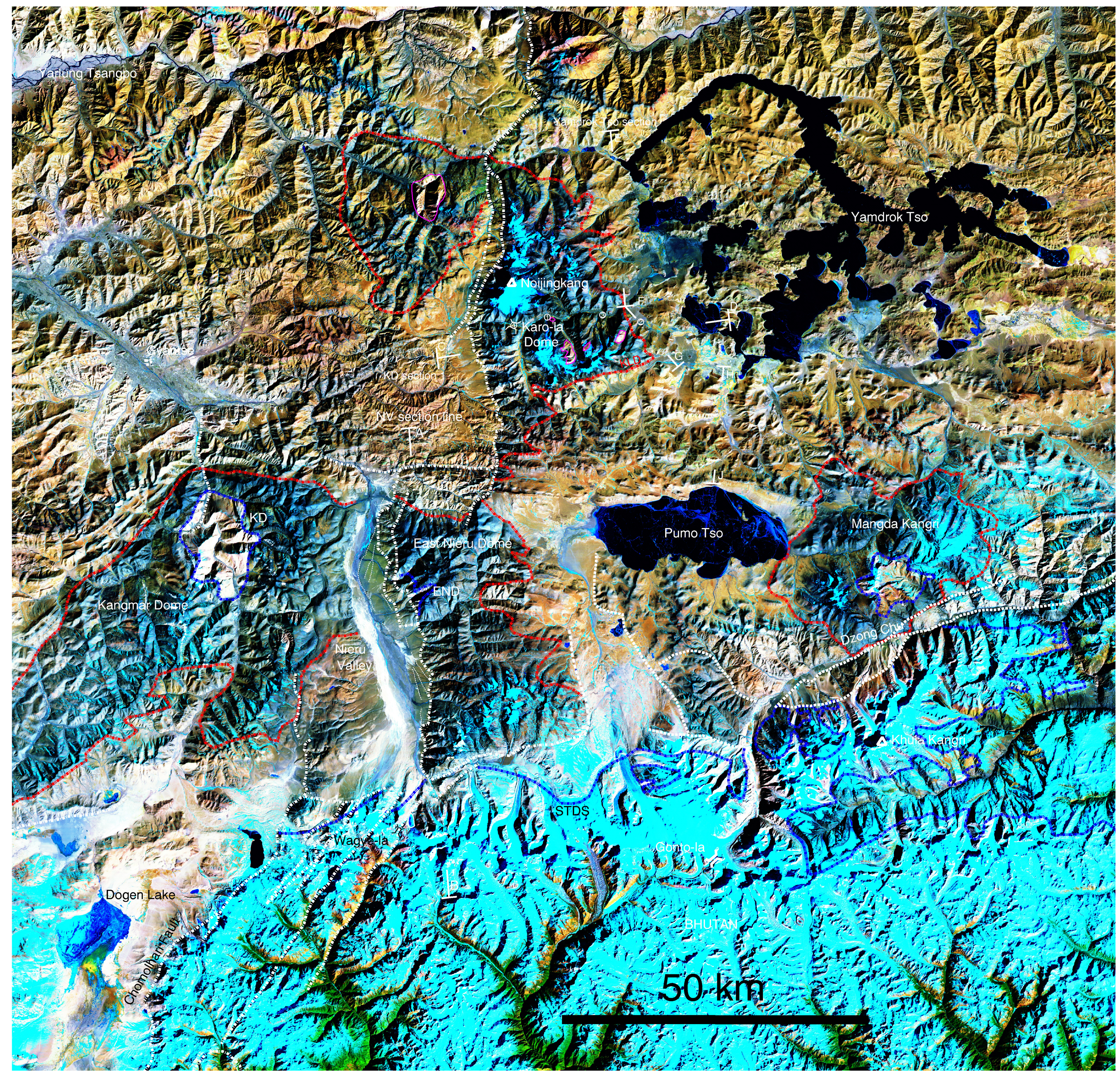
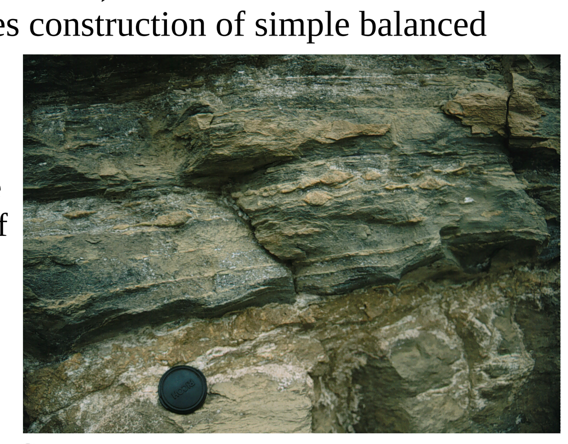
Geologic mapping along the route of the INDEPTH seismic line in southern Tibet (Edwards, 1998) reveals a ~25x30 km dome exposing dark phyllites at the Karo La massif (Noijingkang - 7191m), immediately west of the ~N-S INDEPTH CMP line "TIB-5" on the western shores of Yamdrock Tso. The phyllites in the Karo La massif are >2km thick, lying structurally below the Triassic, and younger, Tethyan sedimentary rocks, all of which are affected by regionally W-E trending, north-dipping, south-vergent folds and thrusts. Kinematic fabric of foliation-parallel quartz veins/sheets, and mineral stretching lineations constrain clear top-to north displacement upon discrete horizons, especially at the top of the phyllite unit, and perhaps within it. In addition, mapping and accompanying TM interpretation show that the regional W-E fabric terminates, and soles into, the top of the phyllite unit upon the N, S, and E sides of the dome (this observation is strikingly re-emphasised on the TM by conspicuous truncation of surface traces/form lines at the margins of the phyllite body. Despite the clear top-to-north sense of shear that is presently observed, we infer that much of the strain within the phyllites was accumulated during "thin-skinned" south-directed folding and thrusting of the Tethyan sequences, during which the phyllite layer (especially the upper portions of the phyllite layer) has acted as a decollement horizon; the Karo La decollement (KLD), that has enjoyed both south-, and subsequently north- directed hanging wall displacement. We infer that the updoming of the phyllite, and the conditions for quartz veins and new mineral growth are related to the emplacement of a 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 - Wu et al, 1998; Cogan et al, 1998). Li et al (1998) have determined a crystallization age of 11.7+/-0.2 Ma (xenotime) for the Karo-la granite. Apatite fission track data from the Karo La granite give an age of 4.7+/-1Ma, and prior geochronology (Copeland, 1990) gives bi and mu Ar/Ar cooling ages of 10.5+/-0.1 and 10.9+/-0.1, respectively. These ages imply exhumation of this segment of the YGRS hanging wall between ~10 and 5 Ma, consistent with general opening of the YGRS at this time (e.g. Nyainqentanglha, Harrison et al, 1995, Wu et al, 1998). We have mapped the same phyllite unit in northern Nieru Valley-Kangmar Dome (Kidd et al, 1995), and in another nearby dome (Mangda Kangri), where the phyllite unit in each case is again present defining the core of the dome structure, and with a normal-sense decollement as its upper surface. We suggest that the phyllite marks a regional layer with an extensional decollement, originally N-dipping, that has been since domed in association with granite emplacement (during which the phyllite unit may have acted as some type of barrier to magma ascent). Ages from the main STDS in this segment of the Himalaya (Edwards and Harrison, 1997, Edwards et al, 1995) suggest that it was active at the same time, or perhaps later (the STDS is structurally lower than the KLD decollement). We remark that the existence of this regional decollement within the Tethyan Himalayan belt makes construction of simple balanced sections (e.g., Ratschbacher et al., 1994) problematic in this part of the orogen.

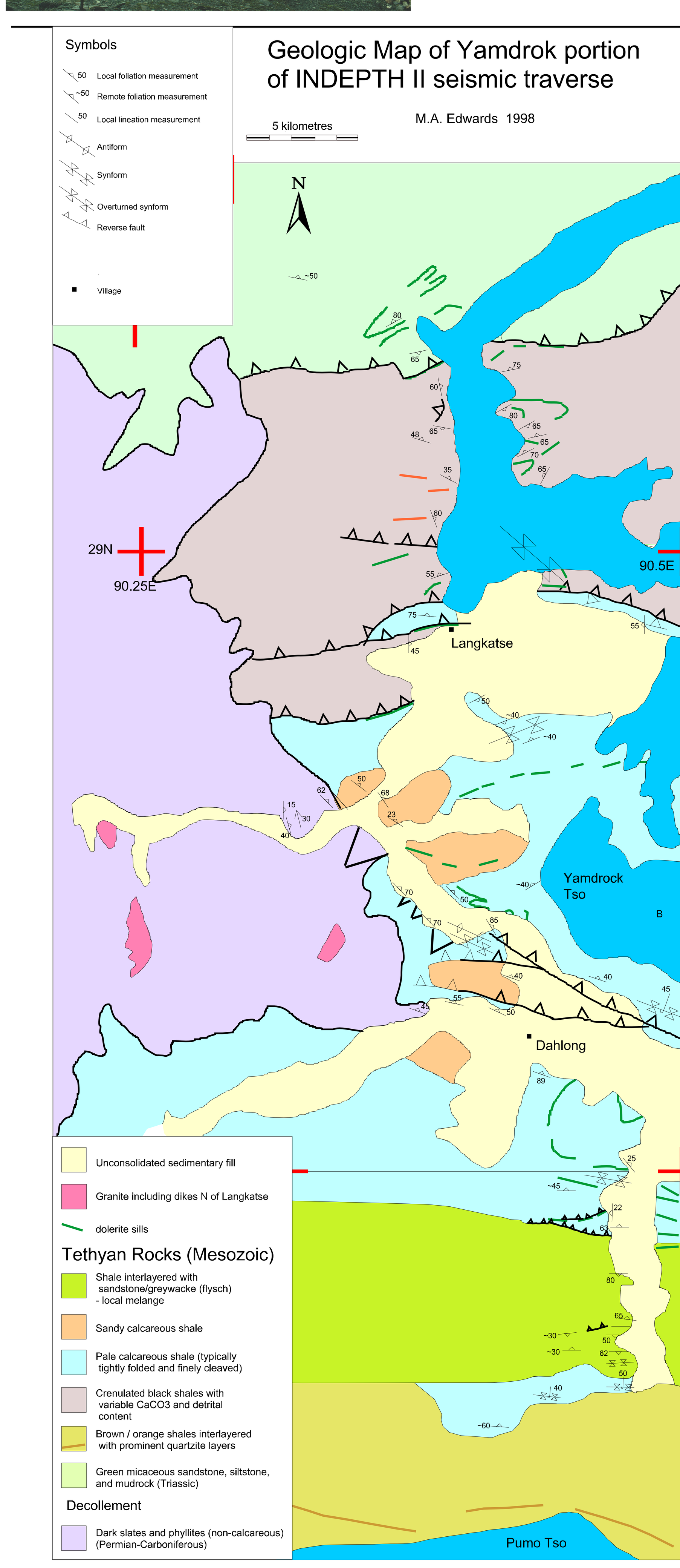
Annotated Landsat Thematic Mapper image (bands 5,4,2) of Yamdrok Tso - Kangmar - Khula Kangri area



4 View to NW from Karo-la pass over the western part of the Karo-La Dome. Peak of Noijangkang in upper right.



3 High strain zone within phyllites along valley east of Karo-la pass. Sense of shear is top to north (to the left).



1 View NW from Karo-la granite to flat-lying phyllites of the core of the Karo-la dome. Peak of Noijangkang is behind cloud in upper left.

2 View NW along SE margin of phyllites of Karo-la Dome (note reflection from talus). Moderately NE-dipping foliation forms high strain zone at top of phyllites - the Karo-la Decollement.

Isotopic Ages from Karo-la Granite

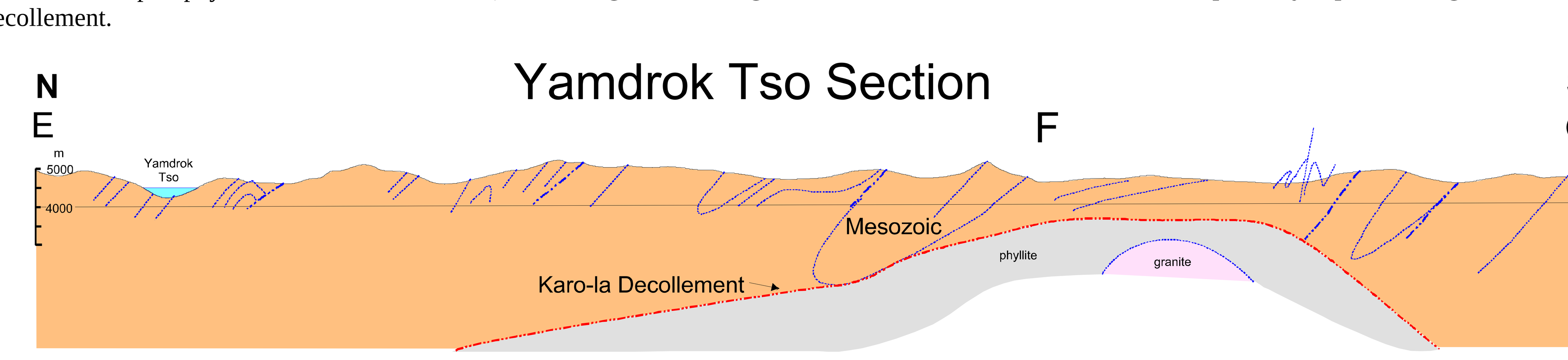
Apatite Fission-track age sample H1 = 4.7 +/- 1 Ma (20 grains) 40.8ppm U

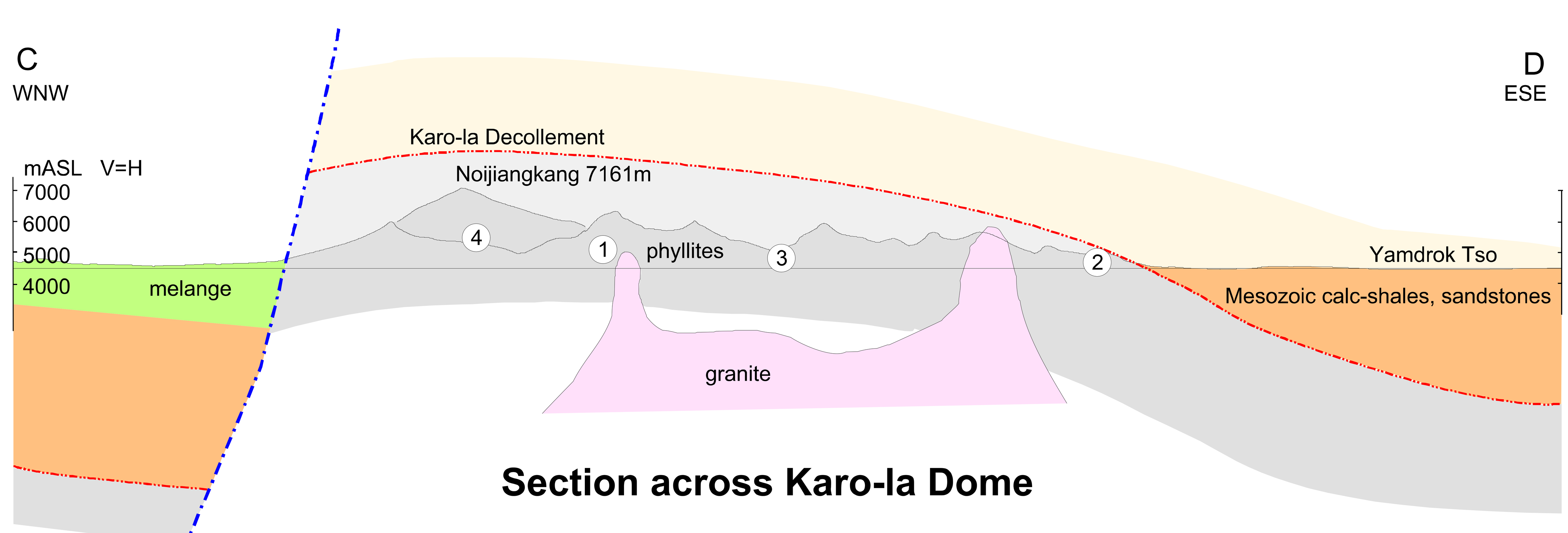
$^{40}Ar/^{39}Ar$ ages H1 biotite = 10.5+/-0.1 Ma (isochron age; flat spectrum)
muscovite = 10.9+/-0.1 Ma (isochron age; flat spectrum)

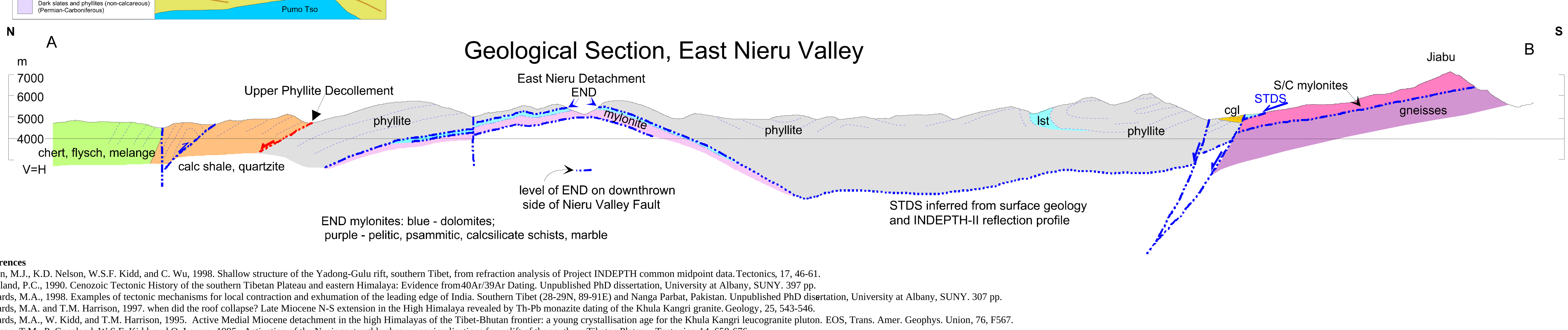
Kspar (lower 40%) = 6.3+/-0.1 Ma (isochron age, steps 1-12)

Crystallization age (Li et al, 1988) 11.7+/-0.2 Ma (U/Pb xenotime)

cooling at ~35 degrees C/Ma from 10.5-4.7Ma (exhumation)
cooling at ~20 degrees C/Ma from 4.7-0Ma (exhumation)
(the cooling of ~125 degrees C/Ma from 10.9-10.5Ma, if real, is possibly rapid cooling after intrusion)







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