Cretaceous flysch in the eastern Tethyan Himalaya

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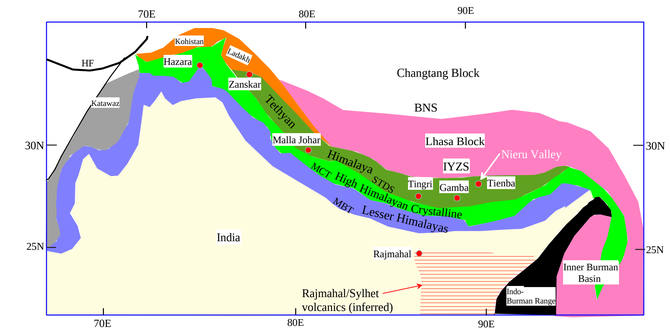
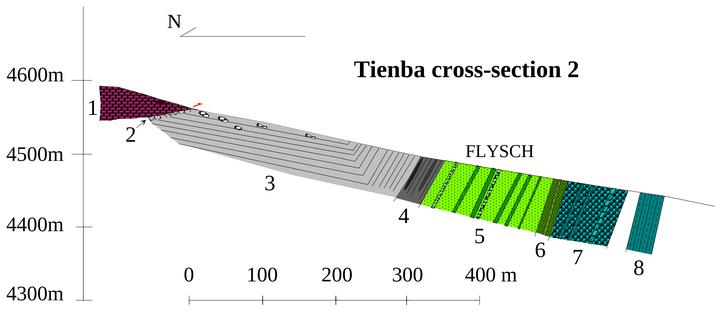
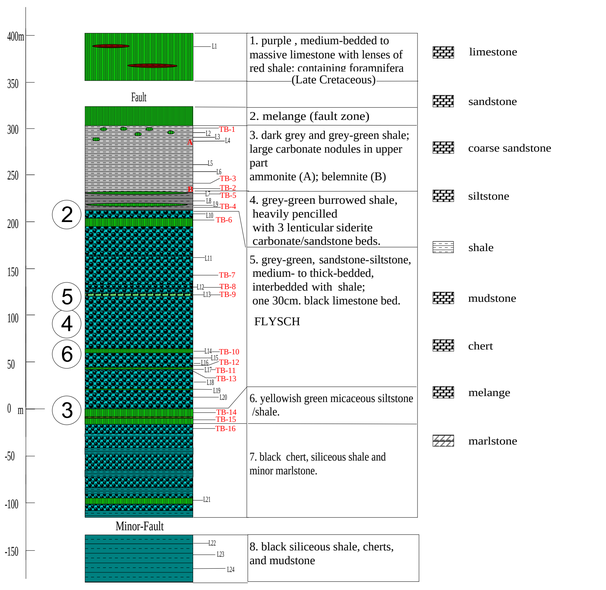
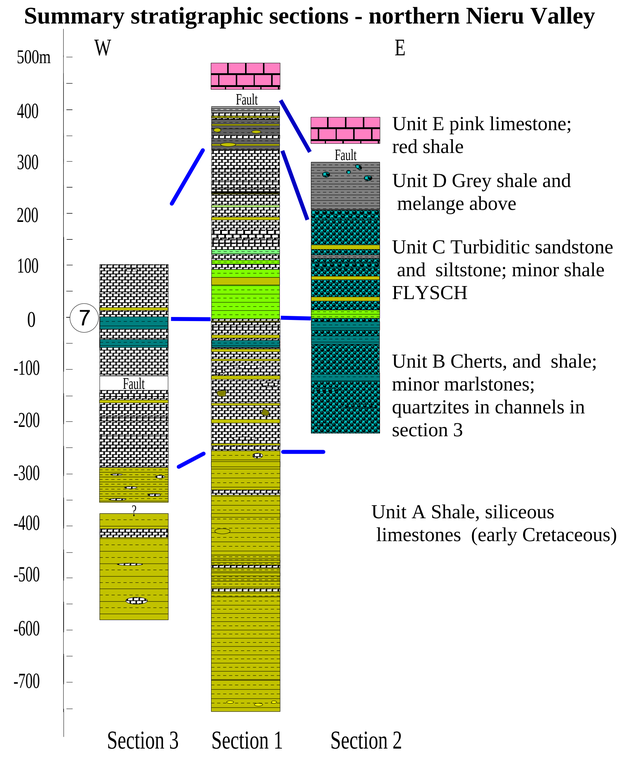
Abstract

Detailed investigation of stratigraphic sections in the region of the Nieru Valley and Gyantse, eastern Tethyan Himalaya, reveal that the Jurassic-Cretaceous-early Tertiary of this region contains a section of lithic-rich turbidite greywackes, which poss ess all the visual characteristics of typical convergent orogenic flysch. The deposition of this flysch can be demonstrated, from its original intact stratigraphic position, to have been within the Cretaceous of the outer Indian passive margin. This sect ion is best preserved in the Nieru Valley, where it is approximately 220m thick. It conformably overlies several hundred meters of section consisting of black shales, cherts and argillites, containing horizons with ammonites. There is a prominent coarsen ing-upwards section about 10 meters thick at the base of the flysch unit, with an abrupt change from black cherts to olive-coloured argillites and micaceous siltstones. Bouma-sequence sedimentary structure assemblages are well-developed in the flysch are nites, which display beds ranging up to several meters thick (amalgamated), many with sharp bed bases displaying flute and groove-type scour marks. Restored paleocurrents are dominantly towards the east in the Nieru Valley section. Preliminary investigation of the clastic provenance suggests that a volcanic-dominated source was mixed with material of highly quartzose composition, since feldspar is a relatively small proportion of the whole, and much of it is plutonic/metamorphic origin. Volcanic clasts contained in the arenites are both mafic and silicic in composition, although the larger clasts perhaps tend to be mafic. No serpentine, and no chromite clasts have been seen in thin sections. In the western stratigraphic sections of the northern Nieru V alley, the basal arenites are greenish or pale quartzites, and first occur as strongly channelised lensoidal bodies within the uppermost 25 meters of the dark cherts and argillites. More lithic arenites succeed these quartzites, although a few of the bed s within the flysch section are also somewhat quartz-rich compared with the average. Arenites cease abruptly at the top of the unit at a sharp contact with greenish-grey burrowed shales. A few thin sideritic carbonate beds occur within the first 30 mete rs above the top of the flysch arenites; 60-70 meters above this contact the shales contain outsize (up to 1 meter across) calcareous nodules. Rare belemnites and an ammonite demonstrate that these shales are Cretaceous. Full exposure shows that the flysch-shale contact is stratigraphic and that no faults of significance occur within the shale section as far up as the large calcareous nodules. There is a significant fault above this level, carrying Cretaceous pink limestone and melange over the dipping, and folded stratigraphic sections described, but the flysch itself is unquestionably within an intact Cretaceous stratigraphic section.
This section was investigated as part of a study to attempt to determine as precisely as possible the age of initiation of the India-Asia collision in the eastern Himalaya, for comparison with the well-determined Eocene age in Zanskar (Gaetani and Garzan ti, 1991; Rowley, 1996). The fact that the Nieru Valley flysch is Cretaceous, and does not appear to contain ophiolitic-derived detritus suggests to us that it is not connected with the India-Asia collision, nor with any pre-collision ophiolite emplaceme nt event on the Indian passive margin (contra Searle et al, 1997). We favour the idea that it is associated with the Rajmahal flood basalt event, and we think that the occurrence of basal quartzose arenites followed by more dominantly volcanic-derived ma terial supports this suggestion, but demonstration of the macro- and microfossil collections.

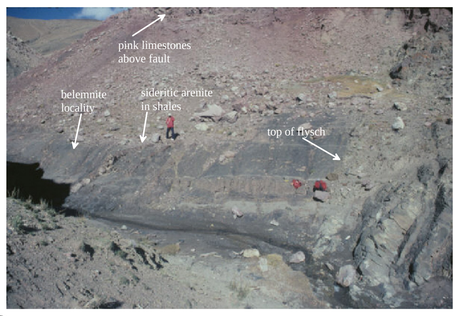








(1) - view NW from northeast corner of Nieru Valley. dark shales and cherts of the early Cretaceous outcrop in the river valley and the lower slopes of the hills beyond;tan-orange band is the Cretaceous flysch; pink-purple rocks above this are fault-juxtaposed late Cretaceous pink limestones and red shales. See Landsat image for location.

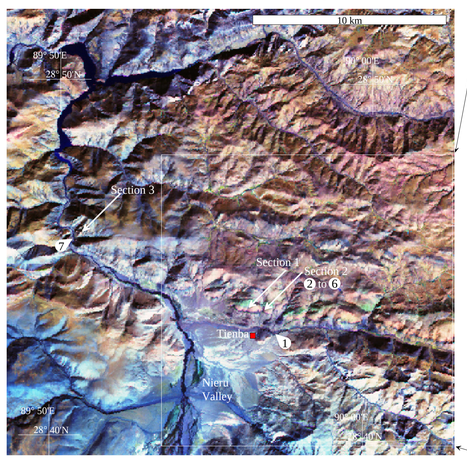


(2) top of the Cretaceous flysch in section 2, north of Tienba. View to ENE. Section youngs to N (left).

(3) Base of Cretaceous flysch unit C in section 2 north of Tienba. View to ENE; section youngs to N (left). Uppermost dark cherts of unit B are on the right; 8 meters of olive micaceous siltstone form the coarsening-up base of the flysch.

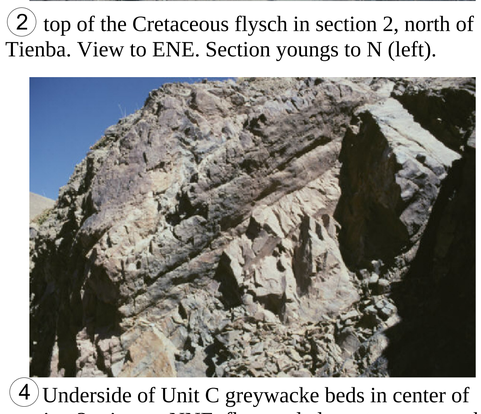
(6) Turbidite greywacke beds in center part of section 2, north of Tienba; view to E, section youngs to N (left).

Landsat TM7 image (1 Nov 2000) band 542 RGB false-colour image

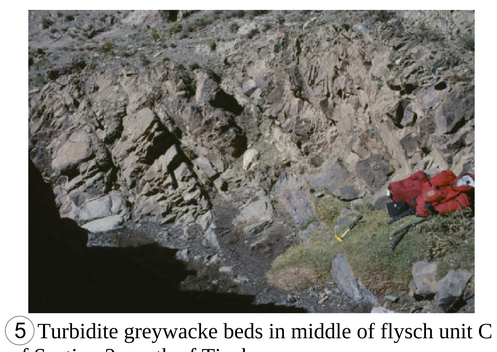


Landsat image with locations of sections

Landsat image detail showing traceable units



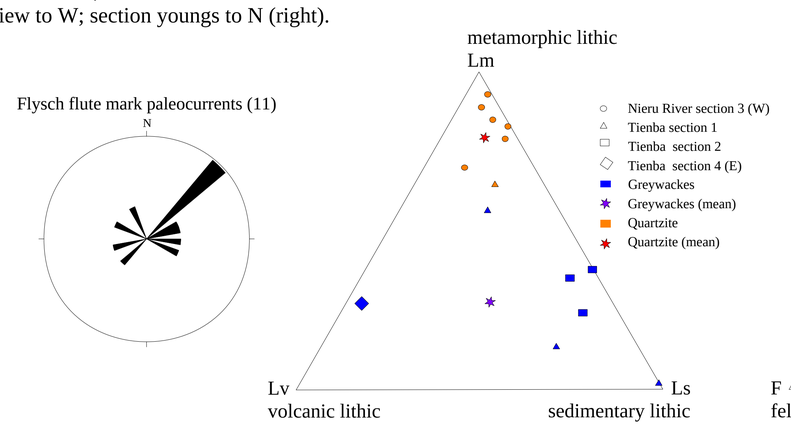
(7) Basal contact zone of Flysch unit C in section 3, NW outlet of Nieru Valley; view to ENE. Thick quartzites in channels (Q) occur here within highest cherts/argillites of underlying unit B. Section youngs to north (left).

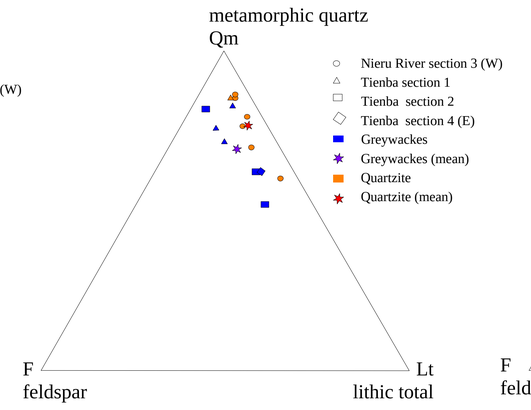


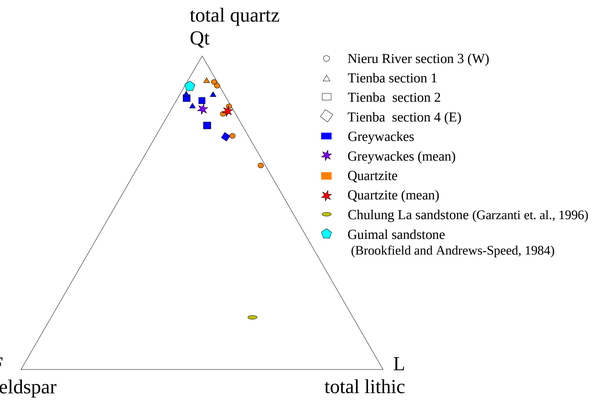
(5) Turbidite greywacke beds in middle of flysch unit C of Section 2, north of Tienba. View to W; section youngs to N (right).

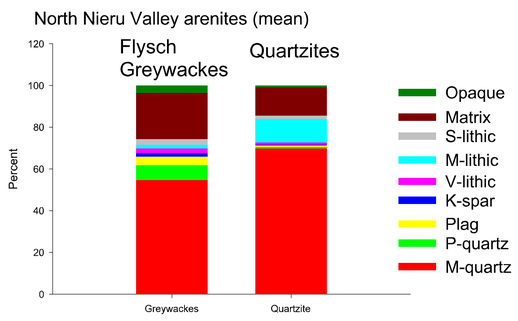
Sandstone petrography

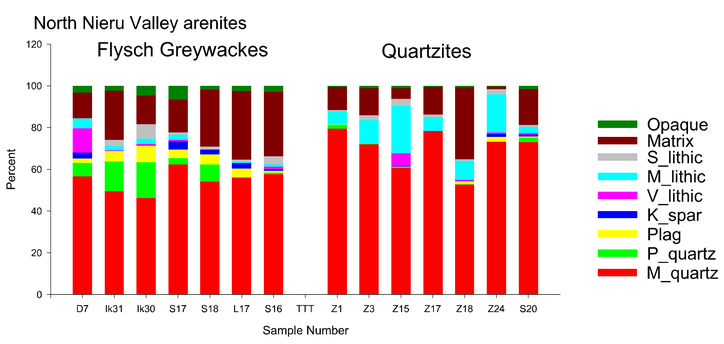
A preliminary examination of the sandstone petrography shows that the Unit C greywackes are distinct from Indian margin arenites and quartzites occurring just below the flysch unit. However, the sandstones are still strongly quartzose compared with accretionary and collisional orogenic flysch.They have 1) more volcanic and sedimentary lithic, and less metamorphic lithic fragments; and somewhat more feldspar, opaques, and matrix. They are significantly different from sandstone of collisional origin from the western Himalaya (Chulung La) but are quite similar to the Cretaceous Guimal sandstones in Zanskar.

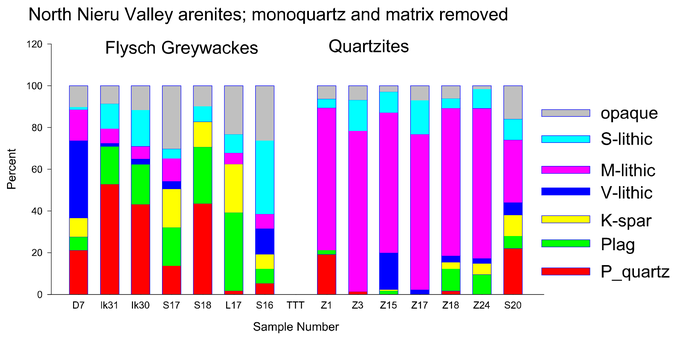












Funding of this project by the National Science Foundation (Tectonics Program, Earth Science Division) is gratefully acknowledged

Presented at 16th Himalaya-Karakorum-Tibet Workshop, Schloss Seggau, Austria, April 3-5, 2001

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