Initial Rising of the Himalaya as Deduced from Petrography of Syncollisional Redbeds (Muree Supergroup, Pakistan, and Chulung La Formation, Tethys Himalaya, India)

TALK

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Based on fieldwork and sampling in Hazara-Kashmir by
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The northern spur of India began to collide with the Transhimalayan arc-trench system around the Paleocene/Eocene boundary (Early Ilerdian; Garzanti et al., 1987).
Flexural response to loading by the overriding Asian accretionary prism caused strong subsidence on the northern edge of the Indian Plate, where collisional basins were rapidly filled by huge amounts of detritus derived from the slowly rising proto-Himalayan chain.
Onset of continental collision is recorded on the Indian margin by a basal unconformity, which is overlain by shallow-marine limestones with intercalated quartzarenitic layers occurring both in the Patala Fm. (Northern Pakistan) and in Lithozone C at the top of the Dibling Fm. (Northern India). This temporary increase of pure quartzose detritus in the very first stage of collision might be ascribed to flexural uplift of a peripheral bulge located on the Indian craton to the south, with erosion of older sedimentary and crystalline rocks.
The sudden arrival of abundant quartzolithic detritus, including serpentineschist rock fragments and chromian spinels derived from both island-arc and mid-ocean ridge ultramafic rocks, indicate that both the Murree and Chulung La redbeds were fed from the Tethyan suture in the north (Garzanti et al., 1987; Bossart & Ottiger, 1989).
This major petrographic change is recorded just below (Hazara-Kashmir) or directly above (Tethys Himalaya) calcarenitic layers dated at the *Fasciolites ellipsoidalis* Zone. Such small time lag (possibly 1 m.y.) may be ascribed to slightly diachronous collision, beginning earlier in the northwestern Nanga Parbat area (latest Paleocene), and progressively later (earliest Eocene) to the east.
It is noteworthy that, among all Tertiary clastic wedges shed from the Himalayan suture belt, the greatest mineralogical differences are observed between the Murree and Chulung La redbeds (Tab. 1), which were both deposited in collisional basins fed from proto-Himalayan reliefs, at the same time, and in very similar sedimentary environments.
Detrital modes of the Chulung La Formation are feldspatolithic, volcanic-rich and quartz-poor, and thus identical to "magmatic arc" sandstones. Since they compare closely with syn-collisional clastics derived from and deposited within the Ladakh arc-trench system (Garzanti & Van Haver, 1988), it can be safely concluded that the Chulung La delta was fed entirely and directly from the obducting Transhimalayan accretionary prism.

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Conversely, detrital modes of the Murree Supergroup plot in the middle of the "recycled orogen" provenance field. Even though erosion of calc-alkalic and ophiolitic rocks incorporated in the Transhimalayan arc-trench system is indicated, low-grade metapelitic detritus was predominant particularly in the Middle Ilerdian to Cuisian lower part of the Balakot Formation (Kunhar River section).
It is difficult to ascribe this feature of the Murree redbeds to an unknown metapelitic source terrane located to the north of or within the suture zone, and it is not conceivable that Mesozoic continental rise pelites of the Indian margin (western equivalents of the Lamayuru Unit of Ladakh) could have undergone metamorphism, uplift and erosion in virtually no time after collision. Abundant phyllite rock fragments were thus most likely derived from proto-Lesser/High Himalayan reliefs made of mildly metamorphosed supracrustal Indian margin rocks, possibly mainly Late Proterozoic to Cambrian pelites overprinted by Pan-African metamorphism. Petrographic evidence suggests that this fold-thrust belt began to be uplifted just south of the Tethys Himalayan Zone since the onset of collision, separating the Chulung La "piggy back" basin from the Murree foreland basin.
Direct stratigraphic superposition of Late Paleocene limestones on top of Precambrian carbonates in the Hazara Syntaxis is consistent with a palaeogeographic position much closer to the Indian craton with respect to the Tethys Himalayan succession, which consists of thick Paleozoic and Mesozoic sediments deposited on the southern shores of Neo-Tethys.
Moreover, the overall petrographical affinity between the Murree Supergroup and younger orogenic sandstones largely derived from the High Himalaya argues in favour of a common source, which evolved during the Tertiary from lower- to higher-grade metamorphic rocks.
Throughout the Murree Supergroup itself, from the Ilerdian-Cuisian part of the Kunhar River section to the Lower Miocene Murree redbeds of the Rawalpindi area, detrital modes in fact changed gradually. Slight increase of detrital feldspars and polycrystalline quartz through time points to progressive deepening of erosion into infracrustal crystalline rocks, until in the late Early Miocene (Burdigalian) a huge hot wedge of Indian crust was rapidly uplifted and carried hundreds of km southward along the MCT. Rise of the Himalayas at this time of major palaeogeographic change, coincides with major changes in detrital modes of sandstones, recorded from the Siwalik foreland basin (Parkash et al., 1980) to as far as the accretionary wedges of Nias and Makran (Moore, 1979; Critelli et al., 1990).

	N	Qt	F	L	Qm	P	K	Qp	Lvm	Lsm	Lm	Lv	Ls
SIWALIKS	29	57	7	36	88	12		11	0	89	63	0	37
NIAS	24	73	11	16	86	9	5	17	23	60	35	29	36
MAKRAN	62	56	10	34	83	12	5	9	36	55	31	37	32
CHULUNG LA	**18**	**24**	**26**	**50**	**44**	**55**	**1**	**5**	**93**	**2**	**2**	**96**	**2**
INDUS GROUP	26	24	34	41	41	45	14	8	68	25	13	70	17
MURREE GROUP	**28**	**68**	**5**	**26**	**92**	**8**	**1**	**21**	**27**	**52**	**39**	**28**	**33**

Table 1 - Detrital modes of Tertiary sandstones derived from the Himalayan suture belt. Note that the Chulung La Fm. and coeval Indus Group feldspatolithic sandstones are much less quartzose and rich in volcanic detritus than the Murree Group and other quartzolithic "recycled orogen" clastic wedges.

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