Conference Report

7th Himalaya–Karakoram–Tibet Workshop

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The first Himalayan Workshop held in Leicester University in 1985 was so successful that it was then agreed to hold the informal conference and workshop annually. Subsequently the Himalayan Workshops were held in Vandeuvre-les-Nancy, France in 1986, London (1987), Lausanne, Switzerland (1988), Milan, Italy (1990) and Grenoble, France (1991). The upsurge in research throughout the Himalayan and Tibetan regions in the last ten years has warranted these annual meetings, and the dissemination of new research throughout the Himalayan community has been invaluable. This year the meeting was held in the Department of Earth Sciences, Oxford University, under the auspices of The Geological Society, London, from 6–8 April 1992. Over 120 participants from 15 countries attended.

The Himalayan chain has long been recognized as the world’s most spectacular example of a continent–continent collision belt resulting from the collision of the Indian plate with the central Asian landmass some 50 Ma ago. Since then India has moved northwards with respect to Asia by over 2000 km at an average speed of 50 mm a–1 resulting in compressional tectonics not only in the Himalaya to the south of the main Indian suture zone, but also active compression in the mountain ranges north of the Indus suture: the Karakoram, Hindu Kush, Pamirs, Kun Lun and Tien Shan, as well as uplift of the 5 km high Tibetan plateau. Crustal shortening has mainly been accommodated by thrusting and folding in the Himalaya, by internal, diffuse lithospheric thickening within the Tibetan plateau, by limited under thrusting of the Indian plate beneath southern Tibet and by some lateral expulsion eastwards of Tibet and southeast Asia out of the way of the indenting Indian plate. The effects of the India–Asia collision are known to extend northwards as far as Mongolia and the Baikal area and older collisional mountain ranges such as the Tien Shan, Altay and Kun Lun have also been reactivated by north–south shortening during the late Tertiary and Quaternary.

The first sessions of the Oxford conference were taken up by a series of papers on the geology of the ranges to the north of the Indus suture zone. M. Brookfield talked on the little-known geology of the Pamirs. B. Windley speculated on the existence of a large-scale mantle plume under the Mongolian plateau, and M. Allen discussed the Cenozoic tectonics of the Chinese Tien Shan. The first results of the large French–Chinese project in the Chinese Pamirs and Kun Lun were reported by P. Tapponnier, M. Brunel and P. Matte and colleagues. They reported fast rates of movement on the strike-slip faults that bound western Tibet and argued that extrusion of the plateau eastwards absorbs at least 30% of the penetration of India into Asia. They showed spectacular evidence of right-lateral and normal movement on the Karakoram fault which offsets Holocene glacial fans by 350 m. They calculate average Holocene slip rates of 3.5 cm a–1 although there remains little evidence that these obviously very high slip rates extended back in time. New data on the Karakoram Ranges in northern Pakistan was presented by the Italian group (M. Gaetani, L. Angiolini, A. Zanchi and colleagues) on the sedimentary history and structure of the north Karakoram shelf sequence. These papers resulted from a recent expedition to the Shaksgam area which included new gravity measurements in the Karakoram by A. Caporali. More geochemical and structural data on the Hunza Karakoram was presented by M. Crawford and M. P. Searle, notably on the post-collisional leucogranite magmatism, and a poster documenting evidence for an Eocene magmatic event in the Batura region was given by F. Debon.

Much new data has recently come out of the north Pakistan section of the Himalaya and the Kohistan island-arc-batholith. J. Ramsay presented a review of the recent Swiss work in the Hazara syntaxis and northern Indo-Pakistan plate rocks. A. Meier described the metamorphic rocks of the Kaghan valley area and D. Spencer and J. Villa presented field and radiometric dating results of the recently discovered eclogites in the upper Kaghan nappe. H. Smith presented new SHRIMP U-Pb zircon dates from leucogranite samples from the Kaghan valley showing that anatexis occurred during the Eocene between 40 and 45 Ma. This supports earlier 40Ar/39Ar and K-Ar data from N. Pakistan (D. Rex, P. Treloar and colleagues) which suggests that peak metamorphism and cooling was older in the Pakistan segment of the Himalaya than further to the east. J. DiPietro and colleagues described the stratigraphy and domal structures around the Swat valley.

Moving north to the Nanga Parbat syntaxis, P. Zeitler and P. Chamberlain reviewed all their recent geoarchaeological and thermobarometric data, which reveal extremely young migmatization ages (3.3 Ma) and an extraordinarily high mean denudation rate of 5 mm a–1 for the past 3 Ma. M. George described some leucogranite occurrences and new thermochronological data across the Main Mantle thrust. G. Potts and colleagues described a detailed structural and metamorphic profile along the Indus gorge section through the Nanga Parbat syntaxis, linking this with constraints from modern earthquake data, and P. Le Fort described preliminary results of a short survey along the eastern margin, the Stak fault zone. V. Cronin presented some Landsat-interpreted fault maps of the Nanga Parbat area, which showed that the area was indeed cut by a large number of faults of many differing orientations, some of which affected river drainage patterns.

Q. Jan, Asif Khan & M. Arif summarized two decades of Pakistani work on the Kohistan island arc sequence, and M. Pettersen and colleagues presented some new Sr, Nd and O isotope data from the Kohistan mantle and crustal sequence. M. Sullivan described the geology and geochemistry of the upper parts of the Kohistan arc in the Dir and Chitral areas, and Z. Ahmed presented data on the ophiolitic leucocratic rocks from Khuzdar. M. P. Coward and co-workers described the passive margin subsidence history of the Pakistani sector of
the plate margin and the subsequent inversion tectonics as this margin underwent south-directed thrusting and shortening.

Moving eastwards into the Indian section of the Himalaya, J. Vannay & L. Spring gave new geochemical data on the Panjal volcanic rocks and the Permo-Carboniferous alkaline granitic magmatism in Lahoul and Zanskar. The Proterozoic and early Palaeozoic granites were described by C. Miller & W. Frank with some Rb-Sr isotope data. Unfortunately there are still very few accurate U-Pb zircon or monazite ages from Himalayan granites, as this is the only dating method with high enough closure temperatures to record the time of crystallization. R. Parrish showed from U-Pb single grain abrasion techniques, that metamorphic monazites from the Langtang area, Nepal, have late Proterozoic ages, whereas monazites and xenotime from the leucogranites show no evidence of inheritance or ages older than 21 Ma. The Langtang area is becoming almost as well-worked on as the famous Manaslu, with new contributions from S. Inger (geochemistry of leucogranites), S. Reddy (structural evolution and Ar laserprobe dating), J. Massey (stable isotopes, fluid movement and thermal evolution), A. Macfarlane (Main Central thrust thermobarometry) and N. Harris (dehydration melting) and their colleagues. The Manaslu region was represented by contributions from A. Pecher & S. Guillon on field and magnetic constraints on the emplacement of the leucogranite, and the Main Central thrust zone in the western Nepal area was described by D. Silverberg.

The structural, metamorphic and thermal evolution of the Higher Himalaya are all intricately related. Due to the tragic death in the Alps of P. Metafiche only two weeks before the conference, his presentation was given by M. P. Searle. A detailed microstructural study of kinematic indicators along the Bhabirathi valley section in Garhwal through the Main Central thrust zone was accompanied by new P-T and 40Ar/39Ar data and K-Ar biotite and muscovite cooling age profiles across the Main Central thrust zone and Vaikrita slab. Apart from these studies in the Garhwal, Langtang and Manaslu sections, the Zanskar area has also seen a lot of new work. M. Dransfield, D. Waters, M. P. Searle & D. Rex presented new thermobarometric, 40Ar/39Ar and K-Ar geochronology and field structural data across western Zanskar. They suggested that peak metamorphism may have been diachronous migrating southwards with time, together with the large-scale structures during the Oligocene–Miocene. Complex microstructures indicate that prograde metamorphism up to kyanite grade and fabric development in the upper structural nappes was early and unrelated to the Main Central thrust. P. Guntli described polyphase metamorphism to the south of the Kish-twar Window and suggested that a pre-Himalayan metamorphic event might have been related to the emplacement of early Palaeozoic granites. A. K. Jain and his colleagues presented field, petrographic and thermobarometric data from the Zanskar Himalaya, particularly emphasizing the extensional tectonics associated with the Zanskar Shear zone.

The same normal fault at the structural top of the High Himalayan gneisses extends right the way across the northern part of the Himalaya. K. Hodges and colleagues described this fault in the Rongbuk area north of Everest where a minimum displacement of 35 km has occurred after the metamorphism. Regional peak metamorphism occurred at 21–22 Ma from hornblende 40Ar/39Ar dating. The detachment is cut by the unfoliated Rongbuk granite pluton from which xenotime gave a concordant U-Pb age of 20.6 ± 0.2 Ma. R. Brown and colleagues described the same normal fault and associated structures in the Thakoka region of Nepal, which is also the site of the well-known N-S-trending graben. U. Pognante, B. Lombardo and colleagues presented the metamorphic, migmatic and anatectic history of the Everest region showing spectacular photos of this classic area. K. Meier described the deformational history and inverted metamorphic zonation in the Arun Window of far eastern Nepal.

G. Oliver and colleagues presented illite crystallinity data from the Lesser Himalaya, both from Garhwal and the Kathmandu region, arguing that although the inverse metamorphism at the base of the Tibetan slab was Himalayan (i.e. Tertiary) in age, metamorphism in the Lesser Himalaya, well to the south of the Main Central thrust was Lower Palaeozoic. The inverted metamorphism of the Main Central thrust zone and Tibetan slab is without doubt Oligocene–Miocene in age, but south of the Main Central thrust, Tertiary thermal effects were generally weak, in places so weak that they have not reset even low-temperature, greenschist facies Palaeozoic metamorphic ages. P. England gave an entertaining talk on his (and P. Molnar’s) interpretation of the inverted metamorphic isograds along the Main Central thrust zone using simple physical calculations, and concluded that an additional source of heat was required to explain peak temperatures in excess of 600 °C during slip on the fault. They suggest that dissipative (frictional) heat at shear stresses of 100 MPa could have provided this extra heat and contribute as much as 13 °C/km to the inverse gradient. B. Grasemann also presented some numerical modelling of the thermal history with relation to the Kulu valley transect in NW India.

The north Indian continental margin sedimentary history was described from the Zanskar area by G. Mascle, A. Nicora & E. Garzanti and from Nepal by S. Durr & M. Gibling and colleagues. The sedimentary history of the Indus suture zone in Ladakh was summarized by A. Robertson and colleagues based both on new field studies as well as numerous previous studies, particularly by French and Italian workers. M. Brasier and colleagues correlated the Himalayan Krol-Tal succession with Proterozoic and Lower Cambrian strata elsewhere in Asia, notably the Yangtze platform and outer Mongolia. The final sessions concentrated on the foreland basin evolution of the Lesser Himalaya and Siwalik belt beneath the Main Boundary Thrust. Examples of the stratigraphy and structure of this belt came from NW India (Y. Najman et al.), Nepal (J. Cather et al.) and several studies from north Pakistan. C. Izatt, P. Warwick, J. McDougal, D. Pivnik & I. Jadoon and colleagues all presented new data on the stratigraphy, structure and balanced cross-sections of these foredeep deposits. The evaporite–controlled faulting and folding in the Kohat Plateau and the foot-wall topography, particularly of lateral ramp systems, were a dominating structural process during this very recent and ongoing shortening.

The conference ended with some talks on the present-day processes which shed light on the evolution of the Himalaya. Much of the erosional products of the Himalaya have been transported along the Ganges and Brahmaputra rivers to have become deposited in the Bengal Fan. Recent ODP drilling in the Bay of Bengal have revealed interesting new data from the isotopic and mineralogical point of view. C. France-Lanord & L. Derry presented exciting results of this work and concluded that the Lesser Himalayan and north Indian margin sediments are less important as sedimentary source rocks than the High Himalayan gneisses and leucogranites, which have been the dominant source of eroded material during the last 17 Ma based on Nd, Sr, O and H isotopic measurements. This is not surprising since the High Himalayan zone has the topo-
graphically highest mountains and the highest erosion and denudation (exhumation) rates, but this also suggests that it has remained this way since the Miocene. The final talks were concerned with the glacial sediment production in the Nanga Parbat region of Pakistan (C. Scott) and a welcome contribution from V. Aisen from Moscow on the snow cover of central Asia as indicators of global change in the earth, oceans and atmosphere.

As usual with these Himalayan Workshop conferences, the friendly and informal atmosphere created a most welcome change from the larger international conferences, and consequently many sessions ended in lively debate and plenty of discussion. This was probably just as well because the usual pleasant, spring-like English weather chose these three days to mimic the monsoonal downpours of the Indian subcontinent. A selection of papers as a result of this conference will be published in a Special Publication of the Geological Society, London, which will be edited by M. P. Searle and P. J. Treloar.

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