Proposed Studentship

Drainage evolution and tectonics of the India-Sundaland boundary, Myanmar.

Supervisor: Ian Watkinson

Project Description

Myanmar straddles the complex oblique plate boundary between Sundaland and India (e.g. Nielsen et al., 2004; Curray, 2005). The Sunda Arc becomes progressively more parallel to Indian plate motion northwards past Sumatra and into the Indo-Myanmar ranges in the north (e.g. Whittaker et al., 2007). Simple strain partitioning between the Sumatra trench and the Sumatran Fault (e.g. McCaffrey, 1996) gives way to a wide zone of distributed deformation throughout Myanmar between the Andaman Sea and the northern Himalayan syntaxis (e.g. Vigny et al., 2003).

Coupled with Neogene collapse of Shan Plateau crust overthickened during Paleogene collision (Searle and Morley 2011), subduction rollback (Morley, 2002), the development of a major dextral fault system, dominated by the Sagaing Fault well inboard of the trench (e.g. Le Dain et al. 1984; Curray, 2005), and a growing transpressional accretionary wedge at the Indo-Myanmar Ranges (e.g. Curray et al., 1979), the tectonic setting of Myanmar has led to complex topographic and drainage evolution.

Three of the great rivers systems draining the eastern Himalaya – the Ayeyawady, Thalwin and Mekong – traverse all or parts of Myanmar before emptying into the Andaman Sea. The Thalwin is deeply incised into the Shan Plateau, while the Ayeyawady follows the route of the Sagaing Fault through the Central Basin before being abruptly diverted around the Pegu Yoma hills, uplifted during the Plio-Pleistocene (Pivnik et al., 1998). The Mekong forms the Myanmar/Laos border and shows 13 km displacement across the Nam Ma Fault (Lacassin et al., 1998), source of a Mw6.8 earthquake in 2011.

In many ways the structural setting of Myanmar is similar to central California – dominated by a major strike-slip system (Sagaing Fault/San Andreas Fault) a broad hydrocarbon-bearing central valley (Central Basin/Great Valley) bounded in the west by young transpressional mountains (Indo-Myanmar Ranges/Coast Ranges) and in the east by a broad uplifted area which includes significant transtension and zones of extreme crustal thinning resulting in metamorphic core complex development (Shan Plateau/Sierra Nevada-Basin and Range). Studies from the California analogue (e.g. Harwood and Helley, 1987) will be used as a template for Myanmar, which remains poorly described and understood.

This PhD project will involve a detailed analysis of Myanmar rivers, drainage basins and tectonic geomorphology. This will mainly be accomplished using remote sensing data such as ASTER digital elevation models, but will also involve fieldwork to log and date using ^{14}C methods key sections of modern and ancient rivers and to study specific faults. The project aims to use this analysis to document the evolution of major river systems in the region, to identify and date areas of uplift and subsidence, to recognise active faults, and to develop a model for the Neogene structural and tectonic evolution of the Sundaland-India plate boundary.

References

Curray, J. R., 2005. Tectonics and History of the Andaman Sea region. Journal of Asian Earth Sciences, 25, 187-232.

Curray, J. R., Moore, D. G., Lawver, L.A., Emmel, F.J., and Raitt, R.W., 1979. Tectonics of the Andaman Sea and Burma. In: Watkins, J., Montadert, L. and Dickenson, P.W. (eds) Geological and Geophysical Investigations of Continental Margins. American Association of Petroleum Geologists Memoir, 29, 189-198.

Harwood, D. S., and Helley, E. J., 1987. Late Cenozoic tectonism of the Sacramento Valley, California. U.S. Geological Survey Professional Paper, 1359, 46 pp.

Lacassin, R., Replumaz, A., and Leloup, P. H., 1998. Hairpin river loops and slip sense inversion on Southeast Asian strike-slip faults. Geology, 26, 703-706.

Le Dain, A. Y., Tapponnier, P., and Molnar, P., 1984. Active faulting and tectonics of Burma and surrounding regions. Journal of Geophysical Research, 89, 453-472.

McCaffrey, R., 1996. Slip partitioning at convergent plate boundaries of SE Asia. In: Hall, R. & Blundell, D. J. (eds) Tectonic Evolution of SE Asia. Geological Society London, Special Publications, 106, 3-18.

Morley, C. K., 2002. A tectonic model for the Tertiary evolution of strike-slip faults and rift basins in SE Asia. Tectonophysics, 347, 189-215.

Nielsen, C., Chamot-Rooke, N., and Rangin, C., 2004. From partial to full strain partitioning along the Indo-Burmese hyper-oblique subduction. Marine Geology, 209, 303-327.

Pivnik, D. A., Nahm, J., Tucker, R. S., Smith, G. O., Nyein, K., Nyunt, M. and Maung P. H., 1998. Polyphase deformation in a fore-arc/back-arc basin, Salin subbasin, Myanmar (Burma). American Association of Petroleum Geologists Bulletin, 82 , 1837-1856.

Searle, M. P., and Morley, C. K., 2011. Tectonic and thermal evolution of Thailand in the regional context of Southeast Asia. In: Ridd, M.F., Barber, A.J., and Crow, M.J., (Eds), The Geology of Thailand, Geological Society of London Memoir, London, UK.

Vigny, C., Socquet, A., Rangin, C., Chamot-Rooke, N., Pubellier, M., Bouin, M.-N., Bertrand, G., and Becker, M., 2003. Present-day crustal deformation around the Sagaing fault, Myanmar. Journal of Geophysical Research, 108, doi: 10.1029/2002JB001999.

Whittaker, J. M., Müller, R. D., Sdrolias, M., and Heine, C., 2007. Sunda-Java trench kinematics, slab window formation and overriding plate deformation since the Cretaceous. Earth and Planetary Science Letters, 255, 445–457.

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