Fingerprinting Himalayan convergence accommodation processes

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Conceptual models of convergence accommodation processses that operated during the Tertiary evolution of the Himalayan orogen have commonly been examined from an 'end member' point of view. Many previous studies have used geologic data to attempt to characterize these processes in terms of either channel flow or wedge taper models. These models, however, are not mutually exclusive [1] as supported by recent field-based research that demonstrates they are intrinscially related both spatially and temporally [2,3]. Key to undertanding the relationship between channel-type mid-crustal flow and wedge taper processes is appreciating the spatial variation in displacement and distortion throughout a large, hot orogen. Moreover, it is also critical to recognize how initially spatially and deformationally distinct domains may be later juxtaposed.

The exhumed metamorphic core of the Himalaya is well exposed in the Manaslu-Himal Chuli region of central Nepal. This transect has been subject to much geologic research including spatially expansive P-T determinations and new geochronologic controls. These data, coupled with detailed mapping that covers most of the exhumed metamorphic core, provide the constraints necessary to characterize the convergence accommodation processes that imparted those characteristics. The lower portion of the exhumed mid-crust is characterized by structurally-downward decreasing P-T conditions and monazite ages interpreted to reflect subcretion of material to the base of the mid-crust as it was exhuming, consistent with wedge taper processes in the shallow foreland [2]. The upper portion of the exhumed mid-crust, however, preserves a condensed right-way up pressure gradient, an invariant temperature gradient, and monazite ages that are consistent with ductile mid-crustal flow in the deep hinterland [3]. The present-day juxtaposition of these two contrasting domains and the characteristics they record is compatible with the crustal scale channel flow models of Jamieson et al. [4]. Channel flow and wedge taper processes are, therefore, not mutually exclusive.

[1] Beaumont and Jamieson (2010) *USGS Open-File Report* **2010-1099**, 2p. [2] Larson et al. (2010) *GSA Bulletin* **122**, 1116-1134. [3] Larson et al. (2011) *Lithosphere* **3**, 379-392. [4] Jamieson et al. (2004) *Journal of Geophysical Research* **109**, B06407.

Mercury exposure in a sub-arctic population 80 years ago

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Mercury exposure to humans from consumption of fish and sea food is a global concern. Mercury releases to the environment from human activities have increased over the past several hundred years. Along with the historical increase in releases, concentrations of mercury in the environment has also increased. As mercury undergo long range transport, elevated concentrations can be found in the environment far from the sources, including in the Arctic. Samples from museum collections, such as, teeth from humans and marine mammals, hair from polar bears and feathers from birds, have shown that mercury concentrations increased rapidly from around 1900 [1].

Historical samples of biological material are scarce and usually only available from a very limited number of individuals . We have come across a set of several hundred human hair samples from a remote population in sub-arctic Norway (a coastal village in Finnmark County) collected as part of a tuberculosis study in the period 1928-1932. A sub set of 218 samples covering all age groups and both sexes was analysed for methyl mercury.

Mean hair methyl mercury concentration was 1.5 mg kg^{-1} (median 1.3 mg kg^{-1}; range 0.3-6.1 mg kg^{-1}). A compareable modern day population (sampled in Tromsø in 2007-2009) had mean hair mercury concentration 1.3 mg kg^{-1} (median 1.0 mg kg^{-1}; range 0.02-11.9 mg kg^{-1}; n=4973) [2]. The relatively similar mean concentrations in the data from around 1930 and from 2007-2009, despite that concentrations of mercury in fish around 1930 were considerably lower than today, are probably due to higher fish intake and hence similar total mercury exposure 80 years ago.

Contrary to the modern day population, the data set from around 1930 shows no differences between age groups or sexes. Modern day data typically show increasing concentrations with age and higher concentrations in men than women. The differences between age groups and sexes in the modern day population can be explained by food consumption habits. The lack of differences between sub groups in the old data probably shows that there were minor differences in food consumption habits, related to high dependency on local fish and limited choice of food due to poverty and relative geographical isolation at the time.

[1] Dietz, R. *et al.*, (2009) *Sci. Total Environ*. **407,** 6120-6131.
[2] Jenssen, M.T.S. *et al.* Mercury exposure and links to human health in Tromsø, Arctic Norway. *Manuscript in preparation.*