Crust-mantle interaction below NE China: Evidence from magma mixing

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The Liaodong Peninsula in NE China contains many examples of mafic microgranular enclaves (MME) occurring in host granitoids that range in composition from monzogranite, with low initial $^{87}Sr/^{86}Sr$ ratios (~0.7052) and strongly negative εNd_i values (~-20) [1], to A-type granite with high initial $^{87}Sr/^{86}Sr$ ratios (~0.7250) and εNd_i values of ~-15 [2]. The MME range from diorite to granodiorite in composition, with moderate initial $^{87}Sr/^{86}Sr$ ratios (~0.7090) and negative εNd_i values (~-12) that are similar to some biotite granites in the area, suggesting the latter may have resulted from crystal fractionation of mafic magma. However, for the majority, whole-rock geochemical and Sr- and Nd-isotopic data rule out simple crystal-liquid fractionation or restite unmixing and are also incompatible with the enclaves forming by crystal accumulation. Instead, mixing of mafic mantle-derived magma with various crustal-derived components is more compatible with the data. In the Gudaoling batholith, the zircon Hf isotopic composition of the enclaves is distinct from the host monzogranite, indicating that both depleted mantle and crustal sources contributed to their origin [3].

Zircon U-Pb data indicate that the MMEs and host granitoids are coeval and formed in the Early Cretaceous; the U-Pb age ranging from ~120-126 Ma. Since the granitoids formed through a complex hybridization process, involving mantle-derived magmas and several distinct crustal components they provide important information on crust-mantle interaction beneath NE China in the Early Cretaceous. This was the period of extensive lithospheric thinning in the area, including possible delamination, and the data will be evaluated in order to place constraints on this process.

[1] Yang *et al*. (2004) *GCA* **68**, 4469-4483. [2] Yang *et al.* (2006) *Lithos* **89**, 89-106. [3] Yang *et al*. (2007) *Contrib. Min. Pet*. **153**, 177-190.

Detrital zircon fission track thermochronometry with implications for the topographic and exhumational history of Taiwan

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We apply detrital zircon fission track thermochronometry to investigate the young orogen of Taiwan, which presents particular challenges due to its youth, rapid rates exhumation and diverse sediment transport systems. The modern detrital record is consistent with basement ages that show much of the orogen is eroding at high rates with basin-wide mean zircon FT cooling ages as young as 0.9 Ma. Western Taiwan is characterized by regions of reset and unreset zircons. The eastern dispersal system of the Plio-Pleistocene is characterized by deep water turbidite systems fed by large rivers that cut through the volcanic arc of the coastal range to deposit sediment in intra- and back-arc basins. We found a sharp transition at 1.9 Ma between older sediments containing no zircons younger than 10 Ma and stratigraphically younger units containing zircons with lag ages under 1 Ma, confirmed with (U-Th/He) dating of these young grains. The western dispersal systems of the Pliocene to modern are more complicated, with primarily shallow marine sandstones and mudstones deposited in the foreland basin. In the Pleistocene, these are progressively replaced by coarse fluvial deposits. We sampled two Plio-Pleistocene sections from central and southern Taiwan exposed in the valleys of the Tsaohuchi and the Chengwenchi, respectively. In southern Taiwan, a population of zircons with mean age between 5 and 10 Ma appears in the late Pliocene; in the earliest Pleistocene the young population shifts to a mean age of less than 5 Ma. In central Taiwan young zircons appear in the late Pliocene, but in the early Pleistocene, this population disappears and we find no zircons under 10 Ma.

The variation in detrital record is consistent with predictions of the topographic and exhumational development of asymmetric wedge orogens. Through the late Miocene to late Pliocene, the wedge top was exposed, but erosion rates were low in response to the low accretionary flux driving topographic growth. In the late Pliocene (at about 3.0 Ma) exhumation rates accelerated rapidly to near modern. Initial exhumation of reset zircons was in the retro-wedge (eastern slope) and these were efficiently and consistently transported down the steep rivers and turbidite channels. In contrast, in western Taiwan, exposure and transport of deeply exhumed zircons out of the pro-wedge was inhibited by tectonic advection of the rock to the east, formation of structurally-controlled geomorphic barriers with longitudinal river systems, and longitudinal sediment transport in the shallow marine foreland basin system.