Seismic evidence for the *α-β* quartz transition beneath Taiwan from Vp/Vs tomography

H. KUO-CHEN[123], F. T. WU[13], D. M. JENKINS[1], J. MECHIE[4], S. W. ROECKER[5], C.-Y. WANG[2] AND B.-S. HUANG[6]

[1]Department of Geological and Environmental Sciences, State University of New York at Binghamton, NY, USA.
[2]Institute of Geophysics, National Central University, Jhongli, Taiwan.
[3]Department of Earth Sciences, University of Southern California, Los Angeles, California, USA.
[4]Deutsches GeoForschungsZentrum – GFZ, Section "Geophysical Deep Sounding", Telegrafenberg, 14473 Potsdam, Germany.
[5]Department of Earth and Environmental Sciences, Rensselaer Polytechnic Institute, New York, USA.
[6]Institute of Earth Sciences, Academia Sinica, Taipei, Taiwan.

Knowledge of the rock types and pressure-temperature conditions at crustal depths in an active orogeny is key to understanding the mechanism of mountain building and its associated modern deformation, erosion and earthquakes. Seismic-wave velocities by themselves generally do not have the sensitivity to discriminate one rock type from another or to decipher the P-T conditions at which they exist. But laboratory-measured ratios of velocities of P to S waves (Vp/Vs) have been shown to be effective. Results of 3-D Vp and Vp/Vs tomographic imaging based on dense seismic arrays in the highly seismic environment of Taiwan provides the first detailed Vp/Vs structures of the orogen. The sharp reduction in the observed Vp/Vs ratio in the felsic core of the mountain belts implies that the α-β quartz transition temperature is reached at a mean depth of 24 ± 3 km. The transition temperature is estimated to be 750 ± 25 °C at this depth, yielding an average thermal gradient of 30 ± 3°C/km.

In a young orogen such as Taiwan where an extensive root system is extant and rapid deformation and uplifting are well-documented, the knowledge of the present P/T conditions and materials in the core of the orogen could help in the understanding of the dynamics of mountain building. The presence of abundant quartz in the continental crust is important in localizing deformation; while hydration weakening as one of the conditions in the feedback processes the α-β quartz transition in Taiwan may play the role. In any case, Taiwan is an excellent site where patterns of strain focusing and crustal weakening during the early stages of tectonic deformation can be explored in detail.

Isotopic and Geochemical Constraints on the Origin of Post-Collisional Mafic Tholeiites from Erkilet, Central Anatolia

BİLTAN KÜRKCÜOGLU[1]*, TANYA FURMAN[2], MEGAN PİCKARD[2], ERDAL ŞEN[1], BARRY HANAN[3], PINAR ŞEN[4], KAAN SAYIT[3] AND TEKİN YÜRÜR[1]

[1] Hacettepe University , Dept. of Geological Engineering, 06800 Beytepe-Ankara, Turkey, biltan@hacettepe.edu.tr
[2]Pennsylvania State University, Dept.of Geosciences, University Park, PA,16802,USA furman@psu.edu
[3]San Diego State University, Dept. of Geological Sciences, San Diego, CA, USA, bhanan@mail.sdsu.edu
[4]General Directorate of Mineral Research and Exploration (MTA) Balgat-Ankara, Turkey, pinar.alicisen@gmail.com

Central Anatolia is one of the most interesting region displaying extensive volcanic activity related to post-collisional extension. Besides stratovolcanoes, most monogenetic vents and smaller volcanoes (e.g., Karapınar, Develidağ, Sivas, Erkilet) are characterized by basaltic lavas that may be alkaline or tholeiitic or both. The field and geographical occurrance of Erkilet mafic lavas are generally similar to those observed in the Sivas area some 100 km to the northeast (1). These two volcanic provinces are located along an ancient suture separating the Anatolide-Tauride blocks. Erkilet basalts have incompatible trace element abundances that are enriched overall relative to primitive mantle values, but they lack the unusually high contents of large ion lithophile and light rare earth elements that typify Sivas basalts, Erciyes tholeiites, and products of the regional mantle lithosphere (2). The Erkilet basalts have low Nb-Ta contents (but not Ti, Zr, Hf) that are typical of arc lavas and suggest a contribution from a source area with rutile that remains stable during shallow melting. Their high Ba/Nb (25-36) and La/Nb (~2) values reflect these low Nb contents, and require a source region distinct from that for MORB or Sivas basalts. Low Rb/Sr (~0.01) and moderate Ba/Rb (33-36) values suggest a source with modal amphibole but not phlogopite, consistent with low Tb/Ybn values that indicate melting within the shallow mantle, i.e., above the garnet stability field. The Sr-Nd isotopic signatures of Erkilet mafic lavas are depleted relative to those of Sivas and Erciyes basalts (~0.7037, 0.5128), consistent with their smooth and OIB-like incompatible trace element abundance patterns. Their Pb isotopic values, however, plot within the range of Sivas and Erciyes basalts that are interpreted as including contributions from a mantle lithosphere affected by enrichment in fluid-mobile trace elements during an ancient subduction event (3). These isotopic signatures are consistent with trace element evidence supporting existence of an arc environment during the evolution of the source region for Erkilet basalts. Further work will explore the nature and degree of interaction between identifiable lithospheric and asthenospheric sources during extension-related melting along this ancient suture zone. [1] Kurkcuoglu 2013, submitted, [2] IGR, **43**, 508, [3] Picard, 2012, Goldschmidt, 2012, 2231.

DOI:10.1180/minmag.2013.077.5.11