Detrital shocked zircon

AARON J. CAVOSIE[1]*, TIMMONS M. ERICKSON[1], HENRI A. RADOVAN[1] AND DESMOND E. MOSER[2]

[1]Univ. Puerto Rico, Mayaguez, PR.
(*correspondence: aaron.cavosie@upr.edu)
[2]Univ. Western Ontario, Ontario, Canada

Of all the interesting geological features created by meteorite impacts, the presence of shock-metamorphosed minerals is one of two critical diagnostic criteria used to confirm a suspected impact structure. Zircon is well-suited for studies of impacts structures, as several unique shock microstructures such as planar fractures (PF) and granular texture have been recognized. Zircon is a common mineral in felsic [1] and mafic [2] crustal rocks, and has long been recognized as being highly resistant to chemical and mechanical weathering. Previous studies of naturally shocked zircon have focused on target rocks and ejecta from known structures [3, 4, 5]. Here we describe characteristics and occurrences of detrital shocked zircon and discuss its application to studies of eroded impact structures.

Planar fractures (PFs) are the most common microstructure in detrital shocked zircon, and are readily recognized on grain surfaces and interiors with SEM imaging; single grains contain 1 to 4 orientations (or sets) of PFs. Suggested criteria for their recognition include: (a) a PF set consists of multiple, parallel, planar fractures, (b) spacing of PFs is <20 microns, (c) PFs occur across an entire grain, although sedimentary abrasion may partially obscure them, and (d) PFs occur in known orientations (5 are currently known: (001), (100), (010), and two un-indexed (hkl) orientations; others may be possible).

Cavosie *et al.* [6] documented detrital zircons with PFs and rare granular texture in fluvial sediments from the 2.02 Ga Vredefort Dome in South Africa. The grains survived post-impact pyroxene hornfels facies temperatures, erosion, and sedimentary transport within the exposed 90 km structure. Similar grains from sand at the base of Inlandsee leucogranofels and Vredefort granophyre outcrops suggest a provenance from the core of the structure. Erickson *et al.* (this volume) have further shown that shocked zircon with PFs, presumably from the Vredefort Dome, occurs in channel sediments in the Vaal River more than 600 km downstream from the structure. These results imply that diagnostic evidence of eroded impacts is likely to be much more widespread in siliciclastic rocks than is currently recognized. Archean sediments in particular may contain an unexplored detrital shocked zircon record of early Earth impacts.

[1] Valley *et al.* (2005). [2] Cavosie *et al.* (2009). [3] Krogh *et al.* (1984). [4] Bohor *et al.* (1993). [5] Wittmann *et al.* (2006). [6] Cavosie *et al.* (in press) *GSA Bulletin*.

U-Pb-Hf characterization of the Coast Mountain batholith: New insights into the crustal architecture of the central Canadian Cordillera

M. ROBINSON CECIL[1], GEORGE GEHRELS[2], JONATHAN PATCHETT[2] AND MIHAI DUCEA[2]

[1]California Institute of Technology, Pasadena, CA 91125
(cecil@caltech.edu)
[2]University of Arizona, Tucson AZ 85721
(ggehrels@gmail.com, patchett@email.arizona.edu, ducea@email.arizona.edu)

We present U-Pb geochronologic and Hf isotopic data from 23 plutonic samples (151 to 52 Ma) within the Coast Mountains batholith (CMB) of north-coastal British Columbia, and from 6 early Paleozoic plutonic samples from the Alexander terrane (SE Alaska). Hf isotopic values do not correlate with age or with variations in magmatic flux, but instead increase from west (ε_{Hf} (T) = +3 to +6) to east (ε_{Hf} (T) = +10 to +14). ε_{Hf} (T) values from Paleozoic plutons of the Alexander terrane range from +9.6 to +14.3. Comparison of our Hf data with Nd-Sr and detrital zircon characteristics of batholithic country rocks places constraints on the crustal architecture of the CMB. The Hf, Nd-Sr, and detrital zircon signatures delineate three discrete crustal domains: (1) a western domain, emplaced into continental margin strata of the Banks Island assemblage, which has evolved Hf and Nd-Sr signatures and mainly Precambrian detrital zircons. (2) A central domain, emplaced into the southernmost Alexander terrane, which has intermediate Hf signatures. (3) An eastern domain, underlain by the Stikine terrane and its inferred metamorphic equivalents, with juvenile Hf and Nd-Sr signatures. Between the Alexander and Stikine terranes is a zone of highly variable ε_{Hf} (T) (+2 to +13) that coincides with mid-Cretaceous through early Tertiary structures (including the Coast shear zone). This large variation in ε_{Hf} (T) apparently result from imbricationof the juvenileAlexander and Stikine terranes with evolved continental-margin rocks of the Yukon-Tanana terrane.