U-Pb ages and Hf isotopes of detrital zircons from miogeoclinal strata of western North America

GEORGE GEHRELS AND MARK PECHA

Department of Geosciences, University of Arizona, Tucson AZ 85721 USA (ggehrels@gmail.com)

U-Pb ages and Hf isotope signatures have been determined from 32 samples of Neoproterozoic, Paleozoic, and lower Mesozoic miogeoclinal strata from western North America. Samples have been collected along five transects in eastern Alaska, northern British Columbia, southern British Columbia, Utah-Nevada, and northern Mexico. Detrital zircon grains from these samples were analyzed for U-Pb by ID-TIMS in the mid-90's to generate a spatial-temporal reference for the ages of grains that accumulated along the western edge of North America. We have recently re-analyzed these samples by CL-based LA-MC-ICPMS to determine more robust U-Pb age distributions (~200 grains/sample) as well as complementary Hf isotope signatures (~50 grains/sample).

U-Pb ages from these samples match well with the ages determined by ID-TIMS, and in most cases resemble the ages of nearby basement rocks. Hf isotope signatures for these detrital grains reveal a fascinating history of crustal genesis and recycling. In southern regions, primary age groups are 1.0-1.2, ~1.4, and 1.6-1.8 Ga, which matches the ages of bedrock terranes in the region. Hf signatures of these grains record generation of juvernile crust at 1.6-1.8 Ga, followed by recycling of this crust during younger magmatism. Central transects contain these same age groups, plus a significant Late Archean contribution. Hf data suggest formation of juvenile crust during Late Archean time, with significant recycling of this crust during 1.6-2.2 Ga magmatism. Little juvenile crust is recorded between 1.6 and 1.8 Ga, whereas, surprisingly, 1.0-1.2 and ~1.4 Ga zircons are considerably more juvenile than coeval grains to the south. Northern transects record protracted magmatism from 3.6 Ga to 300 Ma. Some juvenile crust of early Paleozoic, Early Proterozoic, and Late Archean age is represented, but most grains have Hf compositions that lie between observed 1.8-2.0 and 2.5-2.8 Ga evolution bands. This presumably reflects homogeneous mixing of 1.8-2.0 and 2.5-2.8 Ga crust, rather than recycling of 2.0-2.3 Ga juvenile crust, as the 2.0-2.3 Ga grains present are not juvenile.

Actinium-227 in the Atlantic sector of the Southern Ocean: New results from Bonus-Goodhope and UK Geotraces

WALTER GEIBERT[1]*, ALAN HSIEH[2], CLAUDIA HANFLAND[3], ELISABET VERDENY[4], PERE MASQUE[4], GIDEON HENDERSON[2]

[1]School of GeoSciences, University of Edinburgh, West Mains Road, Edinburgh EH9 3JW, UK (*correspondence: walter.geibert@ed.ac.uk)

[2]Department of Earth Sciences, University of Oxford, UK

[3]Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany

[4]Institut de Ciència i Tecnologia Ambientals - Departament de Física, Universitat Autònoma de Barcelona, Spain

Actinium-227 is a naturally occurring radionuclide, which is released from marine sediments, in particular deep-sea sediments. With a half-life of 21.77 years, it is an excellent indicator of vertical mixing in the deep-sea, and a tracer for upwelling of deep water masses. Therefore, it has potential to be used to quantify fluxes of micronutrients from the deep-sea.

Here, we present new data from the Southern Ocean that were obtained during the UK Geotraces cruise and the Bonus-Goodhope cruise in the South Atlantic. We characterise the main water masses in the Atlantic sector of the Southern Ocean, and discuss to which extent the Ac data can be expected to remain constant over time within water masses.

We also compare results that were obtained by direct alphaspectrometric analyses (Bonus-Goodhope) to indirect measurements by radium delayed coincidence counting (RaDeCC) and discuss the differences of the methods.

If a general input function for Ac from marine sediments could developed, ^{227}Ac could be used to validate deep ocean circulation and mixing in models, analogue to the application of ^{3}H or chlorofluorocarbon as tracers for surface water masses. New depth profiles from the UK Geotraces cruise promise to give new estimates of ^{227}Ac flux from the deep sea, and bring the implementation of ^{227}Ac in models closer.