Crustal evolution in NW Scotland through detrital zircon

PENELOPE J. LANCASTER*, CRAIG D. STOREY AND CHRIS J. HAWKESWORTH

University of Bristol, Dept. of Earth Sciences, Wills Memorial Building, Queen's Rd., Bristol BS8 1RJ, UK (*correspondence: p.j.lancaster@bristol.ac.uk) (c.storey@bristol.ac.uk, c.j.hawkesworth@bristol.ac.uk)

Much recent work on the evolution of the Earth's continental crust has focussed on the ability of refractory minerals, such as zircon, to preserve information about crustal units long since lost from the rock record. Techniques used in these studies include U-Pb ages of crystallisation, Hf model ages of source rock extraction from the mantle, and $\delta^{18}O$ to track recycling of older crust. Such analyses provide insight into a range of questions, from identifying similar (possibly related) source rocks now separated by great distances to whether early crustal production episodes were regionally or globally distributed.

Work on detrital zircons from key areas of Hadean and Early Archaean crust - the Jack Hills, Acasta Gneiss, Slave Craton and Limpopo Belt - has suggested crustal generation was episodic, with distinct peaks every 0.3-0.6 Ga from 4.5-1.2Ga. Younger sediments, such as those in north-west Scotland, serve as a useful comparison to these events. The region comprises different unconformable Proterozoic and Palaeozoic (meta)sedimentary units that have sampled the underlying basement, and potentially basement from further afield within Laurentia and Baltica. While many studies in other localities have presented combined U-Pb and Hf data to identify episodes of crustal production, we present the first correlated *in situ* U-Pb, $\delta^{18}O$ and εHf data from detrital zircons sampled throughout north-west Scotland, from the Loch Maree Supracrustals up into the Cambro-Ordovician sediments. These data identify significant juvenile extraction events at c.2.2 and c.3.3Ga across the region, in broad agreement with events identified elsewhere. There are also hints of a third previously unknown extraction event at c.4.0Ga, preserving a granitic $^{176}Lu/^{177}Hf$ ratio. The timing difference between peaks in Hf model and U-Pb crystallisation ages, particularly at 4.0 and 3.3Ga, requires reconsideration of the earliest crustal growth and consolidation into supercontinents.

Hydrogeochemical cycling of nutrients in a small karst catchment

YUN-CHAO LANG[1], CONG-QIANG LIU[1], HU DING[1,2], WEN-JING LIU[1,2], LONG-BO LI[1,2] AND HAI-TAO LI[1,2]

[1]State Key Laboratory of Environmental Geochemistry, Institute of Geochemistry, Chinese Academy of Sciences, Guiyang 550002, China (langyc822@163.com, liucongqiang @vip.skleg.cn)

[2]Graduate School of Chinese Academy of Sciences, Beijing 100039, P.R. China (tigerding@gmail.com, wenjing-l@163. com, lilongbo1982@163.com, lisea02@126.com)

There exists a mutual relationship between biogeochemical cycling of nutrients and evolution of an ecosystem. In order to understand the factors controlling the degradation of karstic ecosystem in southwest China, we have conducted a systematic research on the biogeochemical cycling of nutrients for a small and specific karstic catchment, through studying rain, surface, soil and spring water samples.

Except for the rain water samples, which have chemical compositions dominated by high contents of calcium and sulfate ions, all of other water samples show dominantly high contents of calcium, magnesium and bicarbonate ions. The sulfur and carbon isotopic compositions were also measured for sulfate and bicarbonate in the water samples, which show variable $\delta^{34}S$ values of from -11‰ to -5.6‰ and $\delta^{13}C$ values of from -8.5‰ to -13.5‰. The rain water samples show the most negative, while the water from a spring the most positive $\delta^{34}S$ values. Relative to the surface water, the deep cycling ground water is characterized by both higher $\delta^{34}S$ and $\delta^{13}C$ values. Another feature of the variation of $\delta^{34}S$ value among the different types of water is that surface water collected from high vegetation-cover area shows low $\delta^{34}S$ and $\delta^{13}C$ values. Accordingly, it can be concluded that various sources of sulfur and carbon and biogeochemical processes controlling their migration in the water-rock-soil-plant system can be traced by the combined $\delta^{34}S$ and $\delta^{13}C$ approaches, and further concluded that degradation of an ecosystem is generally accompanied by significantly loss of nutrients from the system through decomposition of organic matters.

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