The effect of recycling on provenance determinations

P.J. LANCASTER[12]*, S. TYRRELL[3], J.S. DALY[2]
AND C.D. STOREY[1]

[1]SEES, Univ. Portsmouth, Portsmouth, UK
 (*correspondence: penny.lancaster@port.ac.uk)
[2]School of Geological Sciences, UCD, Dublin, Ireland
[3]Dept. of Earth & Ocean Sciences, NUI Galway, Galway,
 Ireland

Sedimentary rocks and modern sediments sample large volumes of the Earth's crust, and preserve units that vary greatly in age and composition. Determining the provenance of component minerals is complicated by the ability of some minerals to be recycled through multiple sedimentary cycles, so minerals from completely unrelated sources may end up in the same sedimentary basin. To untangle these multi-stage signals, two or more chemical signatures measured in minerals with different stability are required, such as K-feldspar and zircon.

New Pb data from throughout the Upper Carboniferous Millstone Grit Group clearly indicate two main feldspar populations, consistent with previous work [1], but also a minor third group which may represent an additional source. The proportions of each group are unchanged throughout the sequence. Zircon U–Pb analyses group into three main populations at c. 450, 1000–1800 and 2700 Ma. The proportion of younger ages increases up section, although the new data indicate a much greater contribution from Archaean material than was previously observed in parts of the sequence [2]. However, Hf model ages indicate only two broad groups at 1500–2500 and 3000–4000 Ma, making this technique too imprecise for provenance work in the N Atlantic region.

Combined, these data create a statistically significant database covering c. 14 Ma of deposition in the Pennine Basin. Ultimate source areas most likely include the Caledonian granites of Scotland, western Scandinavia and Greenland. However, the contrasting distributions of zircon ages and Pb ratios throughout the sequence suggest different transport mechanisms for each. As such, these data have significant implications for transport distances and storage of both labile and refractory minerals.

[1] Tyrrell *et al* (2006) *J. Sed. Res.* **76**, 324-345. [2] Hallsworth *et al* (2000) *Sed. Geol.* **137**, 147-185.