High throughput analysis of mining samples by LA-ICP-MS

ROBERT W HUTCHINSON[1] DAVID PRICE[2] AND ALEX CHRIST[3]

[1]New Wave Research (a division of ESI), 8 Avro Court, Ermine Business Park, Huntingdon, PE29 6XS, United Kingdom. (rhutchinson@esi.com)

[2]PerkinElmer LAS (UK) Ltd, Chalfont Road, Seer Green, Beaconsfield, Bucks HP9 2FX , UK. (david.price@perkinelmer.com).

[3]Bureau Veritas Australia Pty Ltd. 58 Sorbonne Cres Canning Vale Perth WA 6155. (alex.christ@au.bureauveritas.com)

Mining operations rely on fast turnaround of precise and accurate analysis of rock and soil sampled from the field. A large mine can supply up to 100,000 samples to the analytical services per month, each requiring extensive sample preparation for analysis by XRF for composition analysis and solution analysis-ICP-MS for trace elements. The latter is typically performed by sample digestion in *aqua regia*, which has cost, health and safety and disposal considerations.

Here we describe methodology and results for the trace element analysis of XRF discs by laser ablation ICP-MS. This methodology removes the solution digestion sample preparation and its associated costs and risks. Furthermore, the sample type is highly stable long-term and can be recalled for repeat analysis without the need for specialist storage.

Overall, the LA-ICP-MS methodology represents improvement in cost, manpower, throughput and risk when compared to solution ICP-MS analysis.

Indirect dating of the Guadalupian-Lopingian Boundary

M.H. HUYSKENS*, Y. AMELIN[1], R.S. NICOLL[1,2] AND I. METCALFE[3]

[1]Research School of Earth Sciences, The Australian National University, 142 Mills Road, 0200 Acton, ACT, Australia. (*magda.huyskens@anu.edu.au)

[2]Geoscience Australia, Canberra, Australia.

[3]Earth Sciences, University of New England, Australia.

The Guadalupian-Lopingian Boundary (GLB) is defined by the first occurrence of the conodont species *Clarkina postbitteri postbitteri* and currently interpreted to be 259.8±0.4 Ma [1]. The Global Stratotype Section and Point (GSSP) for this boundary at Penglaitan, south China has detailed fossil and chemostratigraphy information available, but unfortunately neither magnetostratigraphy nor geochronolgical studies were successful at the GSSP section.

We have correlated the GSSP section to a terrestrial sequence in the southern Sydney Basin, Australia using C-isotope stratigraphy and present high-precision U-Pb geochronology for five samples covering the Wilton Formation to the Erins Vale Formation tied to C-isotopic values [2] of the drill core Bunnerong DDH 1. Based on C-isotope stratigraphy the GLB in the southern Sydney Basin is interpreted to correlate with the boundary between the Thirroul Sandstone and the Woonona Coal. Based on two bracketing U-Pb ages (256.47±0.14 Ma and 258.04±0.54 Ma, 51 m above and 65 m below the GLB respectively) the age of the GLB is interpreted to be ~ 257.5 Ma.

These new dates can be used to constrain the age of the mid-Capitanian mass extinction. This extinction was previously interpreted to coincide with the GLB, but more recent work suggests a prolonged extinction episode in the mid-Capitanian with different biota becoming extinct at different levels. There is no current consensus on placement of the mass extinction. One of the suggestions is that it occurred at the base of the *Jinogondolella granti* zone coinciding with a major sea-level regression [3]. This regression is recorded in the southern Sydney Basin by an erosive contact between the Erins Vale Formation and the Thirroul Sandstone. This regression is dated at ~ 258 Ma.

[1] Gradstein *et al* (2012) GTS 2012, pp. 1176. [2] Birgenheier *et al* (2010) *P*^{3} **286**, 178-193. [3] Wignall *et al* (2009) *Journal of the Geological Society, London* **166**, 655-666.

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