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supernova event, which started *ca*. 35 ka ago and ended *ca*. 29 ka ago. Before this perturbation the data suggests that the galactic cosmic ray flux was 2.7 times greater than at present.

TRACE-ELEMENT ANALYSIS OF MINERAL GRAINS USING ACCELERATOR MASS SPECTROMETRY – FROM SAMPLING TO INTERPRETATION

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AMS of trace elements in natural materials has been limited to a few labs around the world, the majority of extant data stemming from work in Rochester, Toronto (*e.g.*, Kilius *et al.* 1984) and Oxford. Early analyses utilized time-of-flight systems, whereas recent studies at IsoTrace employ high-resolution magnetic and electric analyzers. Most data concern rare precious metals: Au, Ag, Re and the six platinum group elements (PGE). Most measurements are at ppb to ppm levels, observed abundances ranging from ~0.01 ppb to 0.1 wt.% (Wilson *et al.* 1995). Many public-domain results may be invisible to the broader AMS community; a partial bibliography of PGE-Au-Ag work lists 58 articles, abstracts, reports and theses (Wilson 1994: 33–37).

The key feature of trace-element work at IsoTrace in the 1990s has been the use of AMS results as one component in integrated studies of minerals and metals in rock, meteorite and archaeological samples (e.g., Pavlish et al. 1995). Major and minor elements in chosen grains are often determined by electron microprobe analysis, and trace elements may be analyzed by proton microprobe (PIXE) or SIMS, prior to (more) destructive AMS analysis using a Cs⁺ primary ion beam 300–1000 μ m in diameter. Until now, *in-situ* analysis has been limited to conductive materials which, coupled with the relatively poor spatial resolution, has limited user interest. Reliable interpretation of the results must be based upon a comparison of all available data: textures observed by reflected-light microscopy/SEM, plus the *in-situ* chemical data achieved on scales between 1 and 1000 μ m. It is suggested that one reason for the limited application of AMS in this context during the past 15 yr is the complex nature of the targets. Whereas homogenized (e.g., Rucklidge et al. 1992) or preconcentrated samples can be treated as identical point targets, natural targets require many decisions concerning target selection.

REFERENCES

- Kilius, L. R., Rucklidge, J. C., Wilson, G. C., Lee, H. W., Chang, K. H., Litherland, A. E., Kieser, W. E., Beukens, R. P. and Gorton, M. P. 1984 Charge ratio mass spectrometry of heavy elements. *Nuclear Instruments and Methods in Physics Re*search B5: 185–92.
- Pavlish, L. A., Hancock, R. G. V., Farquhar, R. M., Beukens, R. P., Wilson, G. C. and d'Andrea, A. C. 1995 Distinguishing different European sources of trade copper and brass from archaeological sites in Ontario. Archaeometry 1994, Ankara. In press.
- Rucklidge, J. C., Wilson, G. C., Kilius, L. R. and Cabri, L. J. 1992 Trace element analysis of sulfide concentrates from Sudbury by accelerator mass spectrometry. *Canadian Mineralogist* 30: 1023–1032.

Wilson, G. C., ed. 1994 1993 Annual Report. IsoTrace Laboratory, University of Toronto: 69 p.

Wilson, G. C., Kilius, L. R. and Rucklidge, J. C. 1995 Precious metal contents of sulfide, oxide and graphite crystals: Determinations by accelerator mass spectrometry. *Economic Geology* 90: 255-270.

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