Mine hydrochemistry evolution and water-inrush discrimination based on GIS: A case in Panyi

L. MA[1]*, X.M. WANG[2] AND X.P. ZHOU[1]

[1]School of Resources and Environmental Engineering, Hefei University of Technology, Hefei 230009, China (Lei8505@gmail.com)

[2]Public Geological Survey Management Center of Anhui Province 230001, China

New Method

With the increase of the coal exploitation depth, intensity, rate and scale, coal mining has been under the serious threat of fracture-karst groundwater [1-2]. Many studies show that groundwater flows in fractures are nonlinear and difficult to identify [3-8]. An alternative mothod is to make use of groundwater hydrochemical characteristics and groundwater temperature for discriminating the source of water-inrush. Based on ArcSDE and Microsoft SQL Server, the spatial database for discrimination of water-inrush source of Panyi Coal mine was designed and established. Spatial data mining technology was introduced and applied to the analysis of mine groundwater. Based on Voronoi diagram and DEM methods, the distribution rules of the hydrochemical types and the spatial association rules of groundwater chemistry and structure were mined from the above spatial database. The models for water-inrush source discrimination were studied and coupled with GIS.

Results and Discussion

Spatial data mining technology was applied to analyze the groundwater of mine, and based on Voronoi diagram and DEM methods the distribution rules of the chemical types of groundwater were mined.

A GIS-based identification method of mine water-inrush source with comprehensive information which integrated water level, water chemical and water temperature was proposed, and the application in Panyi Mine showed that the method can improve the precision of discrimination.

A simple, rapid and practical GIS-based system for mine water-inrush source rapid discrimination with comprehensive information was developed. (Grant no: 2009HGCX0233)

[1] Qian *et al*. (2006) *Hydrogeol. J.* **14**, 1192–1205. [2] Qian *et al*. (2009) *Hydrogeol. J.* **17**, 1749–1760. [3] Zhou *et al*. (2004) *Int. J. Rock Mech. Min. Sci.* **41**, 402. [4] Qian *et al*. (2005) *J. Hydrol.* **311**, 134–142. [5] Qian *et al.*(2007) *J. Hydrol.* **339**, 206–219. [6] Qian *et al*. (2011) *Hydrol. Process.* **25**, 614–622. [7] Qian *et al*. (2011) *J. Hydrol.* **399**, 246–254. [8] Chen *et al.*(2009) *Journal of Hydrodynamics* **21**, 820–825.

Olympic Dam U-Cu-Au deposit, Australia: New age constraints

R. MAAS[1], V. KAMENETSKY[2], K. EHRIG[3], S. MEFFRE[2], J. MCPHIE[2] AND G. DIEMAR[3]

[1]University of Melbourne, Australia, maasr@unimelb.edu.au

[2]CODES, University of Tasmania, Hobart, Australia

[3]BHP-Billiton, Adelaide, Australia

The Olympic Dam supergiant U-Cu-Au-REE deposit is located in the Olympic Dam IOCG province of the mid-Archean-Proterozoic Gawler Craton, South Australia. Mineralization is hosted in hematite-rich breccia within the 1590 Ma Roxby Downs Granite, part of the strongly mineralized Gawler Range Volcanic LIP. Initially linked to the GRV event, recent work supports a post-GRV, late-Mesoproteroic age of mineralization. Our Sm-Nd data for step-leached ores are similar to published whole rock data and define an (imprecise) ~1300 Ma apparent age. This is broadly supported by Rb-Sr isochrons for the same step-leach fractions. ε_{Nd} and $^{87}Sr/^{86}Sr$ (at 1300 Ma) are ~-7.5 and ~0.708. Pb isotopes in isotopically zoned pyrite from mineralized clastic sediments and galena in the ore have common Pb model ages which suggest sediment deposition/diagenesis and U introduction no earlier than 1.3-1.1 Ga. These age constraints are consistent with earlier work (ionprobe U-Pb ages in uraninite no older than 1.4 Ga, ReOs dating of chalcopyrite ~1.26 Ga). Evidence for post-ore disturbance is preserved in the form of 450-550 Ma apparent ages for a step-leached sericite-rich ore (Rb-Sr) and a texturally late fluorite-rich vein (Sm-Nd); the ~500 Ma apparent ages are associated with $^{87}Sr/^{86}Sr = 0.715\text{-}0.722$.

Extraction of unequivocal age evidence for this very complex deposit is difficult, and all ages – previously published and new – need to be treated with caution. For example, Sm-Nd isotope systematics are easily modified by local REE redistribution involving Nd-rich ‘nuggets’ of bastnaesite and florencite. Nevertheless, the balance of evidence now indicates a post-1590 Ma age for much of the mineralization in the period 1.4-1.1 Ga. Metal deposition in several stages, from the magmatic GRV event to renewed crustal-scale fluid flow during amalgamation of Rodinia at 1.2-1.1 Ga may explain the enormous size of the deposit.