Factors controlling up- and down-fluid migration in faults associated with a free convection hydrothermal system

Jianwen Yang and Ross Large

Centre for Ore Deposit Research, University of Tasmania,
GPO Box 252-79, Hobart, Tasmania 7001, Australia (Jianwen.Yang@utas.edu.au)

Our previous numerical experiments of a case study on the ore-forming hydrothermal fluid migration in the McArthur basin have revealed that the cold seawater always penetrates downwards along the Tawallah fault and other low-order faults, focuses and travels through the permeable aquifer, and ultimately moves upwards along the Emu fault (Garven and Bull 1999; Yang et al. 2001). It was also indicated that due to the upwelling fluid movement, temperature near the top of the Emu fault is fairly high (~120^{o}C) which is consistent with the temperature interpretation from isotopic studies. Several questions now arise, 'Why cannot the Tawallah fault serve as a discharge (or up-fluid) fault and the Emu fault as the recharge (or down-fluid) fault?' 'Under what conditions these faults will experience a reversal?' 'What are the crucial factors determining the up- and down-fluid migration in the faults?' Solutions to these questions are critical to mineral exploration since the formation of ore bodies is usually associated with the up-fluid or discharge faults.

This paper aims to resolve the above questions. Our recently developed computer package (Yang and Large 2001) is employed to conduct the case studies and sensitivity analysis following the previous numerical studies in the McArthur basin (Garven and Bull 1999; Yang et al. 2001). Different factors governing the fluid migration pattern in the faults as well as the ambient host rocks and hence the heat

transport are identified, including thermal conductivity, permeability, subsurface topography of aquifer and thermal boundary conditions. This will help to develop efficient exploration criteria for stratiform Zn-Pb ore deposits.

References

Garven, G. and Bull, S. 1999. Fluid flow modelling of the HYC ore system, McArthur Basin, Australia. In Stanley, C.J. (ed.) Proceedings of the Fifth Biennial SGA Meeting and the Tenth Quadrennial IAGOD Symposium, Longdon, UK, August 22-25.

Yang, J. and Large, R. 2001. Computational modelling of hydrothermal ore-orming fluid migration in complex earth structures. In Xie, H., Wang, Y. and Jiang, Y. (ed.) Proceedings of 29 th International Symposium on Computer Applications in the Minerals Industries, 115-120. Beijing, China, April 25-27.

Yang, J., Large, R. and Bull, S. 2001. Numerical simulation of transient hydrothermal fluid migration associated with the formation of mineral deposits in the McArthur basin. In Williams, P.J. (ed.) Extended Abstract of 2001 Hydrothermal Odyssey, 228-229. Townsville, Queensland, May 17-19.