British Geological Survey

# Super deposits — super fluids?

## *Studying minute amounts of ore-forming fluids*

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Increasing interest by the minerals industry in 'super' deposits and the critical importance of such deposits to national economies has highlighted our very poor scientific understanding of this class of deposit. These resources now account for more than 75 per cent of the world's supply of non-ferrous metals and yet we are unable to explain or predict their phenomenal metal endowment. Olympic Dam, South Australia, one of the best known examples, has estimated reserves of 2000 million tons of ore, containing 1.6 per cent copper, 0.06 per cent uranium oxide, 3.5 grams per tonne gold and 0.6 grams per tonne silver.

Descriptions of Olympic Dam and other 'super' deposits often refer to multi-stage mineralisation as a mechanism for metal enrichment (i.e. hydrothermal reworking, with concomitant upgrading of the ore). However, although this idea is conceptually attractive, similar features are shown by much smaller or lower-grade deposits. For the geochemist, this raises the exciting possibility that 'super' deposits may owe their origin to the activity of anomalously rich metalliferous fluids.

To investigate this hypothesis, the BGS has developed the analytical capability for determining the metal content of individual fluid inclusions in a wide range of ore and gangue minerals. Known as LAMP-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry), the technique utilises a powerful, ultra-fine laser beam to drill into selected inclusions and vaporise the contents for ICP-MS analysis. Preliminary data for several world-class copper-molybdenum-gold porphyry deposits confirm that the ore fluids contained exceptionally high levels of metal (100 ppm to several 1000 ppm); in some instances an order of magnitude greater than predicted theoretically. The figure shows the LAMP-ICP-MS signals for copper, zinc, silver and lead for a 50-micron-diameter fluid inclusion in vein quartz from a well known porphyry copper-gold deposit.

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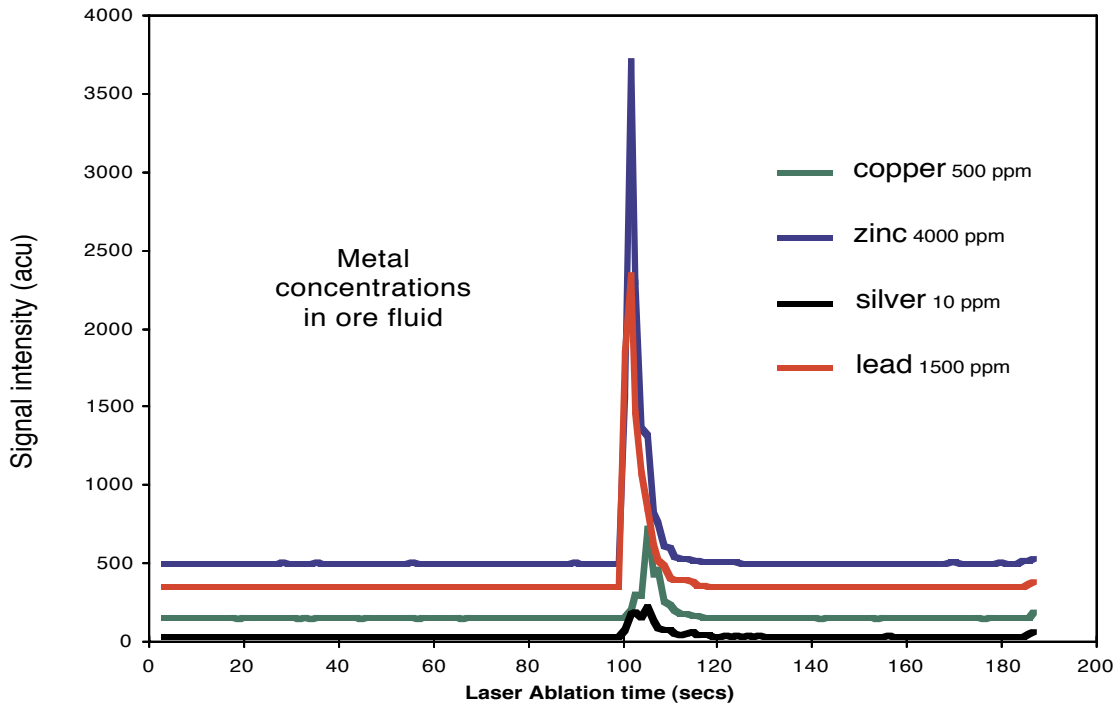
From a practical point of view, metal enrichment vectors for the ore fluids offer a new approach to the ranking of prospects and can be considered complementary to drill core assays — 'high metal content, high prospectivity'. At present our database is too small to be truly predictive, but the evidence acquired is consistent with the hypothesis that 'super' fluids may have played an important role in the formation of 'super' deposits.




*Laser-ablation analysis of a fluid inclusion from a porphyry copper-gold deposit.*