# The age of the Border Cave 5 mandible

RAINER GRÜN[1], PETER BEAUMONT[2], PHILLIP V. TOBIAS[3] AND STEPHEN EGGINS[4]

[1] Research School of Earth Sciences, The Australian National University, Canberra ACT 0200, Australia (Rainer.Grun@anu.edu.au)
[2] McGregor Museum, P.O. Box 316, Kimberley 8300, South Africa (se@museumsnc.co.za)
[3]Sterkfontein Research Unit, School of Anatomical Sciences, University of the Witwatersrand Medical School, 7 York Road, Parktown 2193, South Africa (tobiaspv@anatomy.wits.ac.za)
[4] Research School of Earth Sciences, The Australian National University, Canberra ACT 0200, Australia (Stephen.Eggins@anu.edu.au)

Human remains are scarce and extremely valuable, therefore any sort of destruction for dating has to be kept to an absolute minimum. This is of particular importance in Australia where any human fossils are sacred. Thus, for the analysis of hominid material it was necessary to develop a more or less non-destructive techniques. This has been accomplished in recent years by the application of ESR dating of tooth enamel and a combination of gamma spectrometric and TIMS U-series dating of bones. The example of Border Cave 5 is used to illustrate the potential of these methods in palaeoanthropology.

# Peculiar Geochemistry of Massive Sulphide Deposits in the Nanling Area, South China

L. X. GU, W. X. HU AND P. NI

State Key Laboratory of Endogenic Mineral Deposits, Nanjing University, 210093, China; Department of Earth Sciences, Nanjing University, 210093, China lxgu@nju.edu.cn huwx@nju.edu.cn peini@nju.edu.cn

There are more than 10 Devonian and Carboniferous massive sulphide deposits in post-Caledonian intra-continental basins in the Nanling area of South China, examples being Yongping (Cu, W), Dongxiang (Cu, W), Dabaoshan (Cu, W), Fankou (Zn, Pb), Yushui (Cu, Pb, Zn), Dachang (Sn, Zn, Pb, Sb), etc. These deposits are hosted in marine sequences dominated by clastic and carbonate rocks with intercalations of mafic and acidic volcanites.

Geochemically, the deposits are characterized by high contents of W, Sn, Sb, Hg and Bi. Each of the Yongping and Dabaoshan mines has $WO_3$ reserve of 0.1 Mt. Sulphide ores at Dongxiang have $WO_3$ contents averaging 0.11 wt%, and haematite ores in the same deposit contain 0.4 - 0.6 wt% $WO_3$. Stratiform pyrrhotite ores at Yindingge usually contain 0.025 - 0.126 wt% $WO_3$. Tungsten is an important component in the Qianfeng mine. Two samples from the Yushui mine average 0.358 wt% $WO_3$ and 0.029 wt% Sn. The Dachang mine has a total reserve of more than 1 Mt Sn, and the richest orebody have an average of 0.71 wt% Sn. Antimony is also an economic metal in this deposit. Massive lead-zinc ores in the Fankou mine average 0.016 wt% Sb and 0.0135 wt% Hg. Sulphide ores in the Tianliao mine average of 0.04 wt% Sb. Ores of the Dabaoshan mine have an average of 0.04 wt% Bi, but values up to 0.4 wt% Bi have also been reported. Exhalative iron-manganese ores genetically related to the massive sulphides are also characterised by high contents of these elements.

Tungsten occurs as scheelite in sulphide ores and as wolframite in iron-oxide ores. Tin occurs chiefly as cassiterite, while antimony as stibnite and bismuth as bismuthinite. Mercury is mainly scattered in the lattice of sphalerite, although cinnabar has been identified in the Fankou deposit.

Enrichment of W, Sn, Sb, Hg and Bi in the upper Palaeozoic massive sulphide ores could be genetically linked to high concentrations of these elements in the lower Palaeozoic sequence, which forms the basement of the basins. They were mobilised by circulating submarine fluids to the ore layers during the upper Palaeozoic time.

Apart from massive sulphides, there are numerous famous W, Sn, Sb, Hg and Bi deposits of various genetic types in the Nanling area. All these deposits could be considered as derivatives of the W-, Sn-, Sb-, Hg- and Bi-rich continental crust of South China.