Dating Ore Deposits using the Te-Xe system.

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The Te-Xe dating technique relies on determining the ratio between the ^{130}Xe decay product and its parent ^{130}Te [1]. ^{130}Xe accumulates in telluride minerals due to ββ-decay of ^{130}Te, while ^{131}Xe is produced from ^{130}Te by neutron capture, so Xe isotopic analysis of irradiated tellurium-rich minerals allows a xenon closure age to be determined [Fig 1]. The technique can be applied to sub-mg. samples, and in contrast to other methods which date deposits indirectly, ββ-decay of ^{130}Te to ^{130}Xe has the potential to give a direct age of ore minerals. We report data from ore deposits in Wales, Colorado, Western Australia and Uzbekistan.

We employ the University of Manchester's unique resonance ionization mass spectrometer RELAX (Refrigerator Enhanced Laser Analyser for Xenon). Samples are analysed by laser step heating.

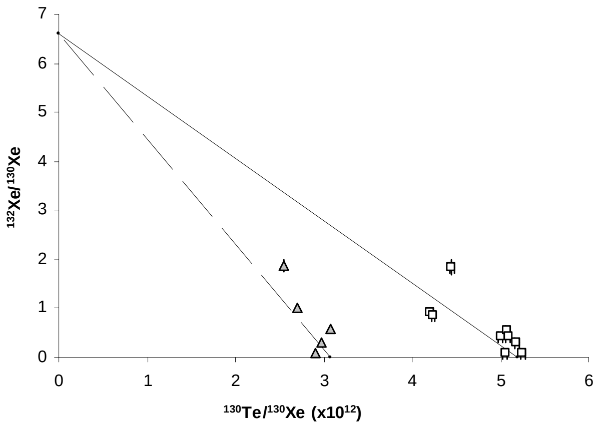

Figure 1. Te-Xe isochron diagram for Kochbulak data (squares) reveals mixing between air xenon and a pure-tellurium component. Good Hope data (triangles) and isochron (broken line) are shown for comparison.

Identifying closure to Xe loss with the accepted age of mineralization of Kochbulak leads to a ^{130}Te half-life of 9.62 $\pm$ 0.2 x 10^{20} yr using data from Kochbulak. Using this value, the data from Clogau Gold Mines, Wales, suggest an age of 331 ± 9 Ma; the data for Good Hope Mine, Colorado suggest an age of 490 ± 13 Ma; and the data for Kalgoorlie, Western Australia suggest an age of 2.38 ± 0.06 Ga. These ages represent closure of the minerals to xenon loss which may be affected by post-formational resetting events.

References

[1] Kirsten T., Shaeffer E., Norton E., and Stoenner R.W. (1968) *Phys. Rev. Lett.* **20,** 1300-1303.