

I-XE DATING OF CHONDRULES AND MATRIX FROM THE QINGZHEN AND KOTA-KOTA EH3 CHONDRITES. J A Whitby¹, R D Ash², J D Gilmour¹, M Prinz² and G Turner¹, ¹Department of Earth Sciences, Manchester University, Manchester M13 9PL, U.K. Email: jwhitby@fs1.ge.man.ac.uk ²Department of Mineral Sciences, MRC NHB-119, National Museum of Natural History, Smithsonian Institution, Washington DC 20560, USA. Email: ASH.RICHARD@NMNH.SI.EDU

Initial iodine ratios similar to that of Shallowater have been obtained for components from Qingzhen and Kota-Kota. These two EH3 chondrites show no evidence of hydrothermal alteration, and metamorphic temperatures are not thought to have exceeded 600°C [1,2]. As a result, in these meteorites the iodine-xenon chronometer may be recording the primary crystallization age.

In a continuation of work by [3], chondrules and matrix were separated from Qingzhen (EH3) and Kota-Kota (EH3) and cleaved into two or more pieces. The largest aliquot in each case (typically 0.5mg) was neutron irradiated prior to xenon isotopic analysis by laser step-heating in the RELAX mass spectrometer [4] and the rest of each sample retained for petrographic and mineralogical characterization. The aubrite Shallowater was used as an iodine standard for the irradiation [5,6].

Qingzhen

Iodine contents in the Qingzhen samples ranged from 3.2ppb (QM1 - matrix) to 34ppb (QC7 - porphyritic pyroxene/olivine chondrule). There does not appear to be any correlation between initial iodine ratio and petrology or halogen content, although there is some evidence that the chondrules contain more iodine than the matrix.

Seven of the eight chondrules analysed gave well defined high-temperature initial iodine ratios. If initial iodine ratios are interpreted to reflect closure ages, they vary from 1.1±0.3Ma before Shallowater to 1.3±0.5Ma after, with a mean age indistinguishable from that of Shallowater. The chondrule (QC1) that did not give a good initial iodine ratio appeared to have been disturbed by the late addition of iodine or loss of xenon. The ¹²⁹Xe/¹³²Xe ratios of the accompanying trapped component (where present) were all close to one, consistent with the ordinary chondrite value of 1.04 [7].

Three of the chondrules appeared to contain a second low-temperature component with finite (¹²⁹I/¹²⁷I)₀ corresponding to ages some 70Ma after Shallowater closure. The accompanying trapped gas was again similar to the ordinary chondrite value for ¹²⁹Xe/¹³²Xe.

Three of the five matrix samples analysed gave initial iodine values similar to those of the chon-

drules. There was also some evidence of the later low-temperature iodine derived component.

Kota-Kota

Three chondrules and one matrix sample were analysed. Iodine contents varied from 2.0ppb (in KC4) to 13ppb, generally rather lower than those observed in the Qingzhen samples. Chondrules KC1, KC2 and the matrix portion KM2 all have initial iodine ratios indistinguishable from that of Shallowater (within error) and a trapped ¹²⁹Xe/¹³²Xe value close to one. Chondrule KC4 has an apparent excess of ¹²⁹Xe due to a lower-temperature trapped xenon component with a ¹²⁹Xe/¹³²Xe ratio of 1.18±0.03. In addition, the two highest temperature releases suggest an initial iodine ratio similar to that of the other Kota-Kota samples. This is consistent with an equilibration of xenon isotopes in some phases during evolution of the ¹²⁹Xe/¹³²Xe ratio in a closed system [8].

Conclusions

The I-Xe system has not in general been disturbed by later thermal events reflected in other chronometers for Qingzhen [9,10]. The mean ages for both Qingzhen and Kota-Kota fall between those previously observed for the EH(4,5) and EL(6) chondrites [8], posing problems for models of formation of the enstatite parent bodies in which metal-rich components aggregated before silicate-rich components [11]. We interpret high-temperature initial iodine values as dating chondrule formation whereas the low-temperature component appears to be dating a later alteration event.

References

- [1] McSween *et al.* (1988) in: Meteorites and the Early Solar system (ed. Kerridge and Matthews) Univ. Arizona Press p102
- [2] Zhang and Sears (1996) *Met. Planet. Sci.* **31** 647
- [3] Ash *et al.* (1997) *LPSC* **28**
- [4] Gilmour *et al.* (1994) *Rev. Sci. Instrum.* **65** 617
- [5] McCoy *et al.* (1995) *Geochim. Cosmochim. Acta* **59** 161
- [6] Gilmour *et al.* (1997) accompanying abstract
- [7] Lavielle and Marti (1992) *J. Geophys. Res.* **97** 20875
- [8] Kennedy *et al.* (1988) *Geochim. Cosmochim. Acta* **52** 101
- [9] Torigoye and Shima (1993) *Meteoritics* **28** 515
- [10] Jessberger (1983) *Meteoritics* **18** 321
- [11] Baedecker and Wasson (1975) *Geochim. Cosmochim. Acta* **39** 735