Numerous meteorites that were recently recovered in China were made available for scientific investigation. We obtained 27 chondrites collected recently in China for characterization of their exposure and formation history and their noble gas inventory [1]. Some other meteorites that were not previously analyzed are also included (see below). The following main conclusions are obtained:

(1) The heavy noble gases of Xingyang H5 and Ningqiang CK-an were extracted by pyrolysis in five temperature steps (Fig. 1). Trapped Xe release is very different for these two chondrites: for Xingyang 87% of Xe is released at >1200°C whereas for Ningqiang only 5% of Xe is outgassed at this temperature. Fig. 1 shows that ordinary chondrites and the Kenna ureilite [2] release Xe at considerably higher temperature than C-chondrites. There are several explanations for this behavior: a) if carbon is the planetary trapped gas carrier in carbonaceous [3] and ordinary chondrites, it may be that the ordinary chondrites were partly degassed, perhaps during metamorphism, in the temperature range where the carbonaceous chondrites are observed to release most of their planetary noble gases. b) The carrier phases of the trapped noble gases in ordinary and in carbonaceous chondrites may not be the same, the one for the O-chondrites being a phase melting at higher temperature than that of C-chondrites. c) The C-chondrites may contain phases that reacted with the material in which the samples were wrapped causing gas release at low temperature.

(2) Ngawi (LL3) contains solar noble gases [4]. Solar gas-rich meteorites and lunar soils and breccias plot on a mixing line of a 20Ne/22Ne vs. 4He/3He correlation (Fig. 2). The endmembers are solar wind [5] and solar energetic particles (SEP) [6]. Fig. 2 shows that meteoritic and lunar samples [7] indicate an increase of the SW/SEP flux ratio with time [8] based on 20Ne/22Ne and 4He/3He.

(3) Cosmic-ray exposure ages were calculated from 3He, 21Ne, 38Ar, 85Kr, 126Xe, and 81Kr-Kr. All meteorites with T3<T21 (3He loss) yield T4<T40 (U/Th-3He age < K-Ar age) i.e. 3He loss. On the other hand, for many chondrites T3 is concordant with the exposure ages calculated from other nuclides but they still yield T4<T40. In Fig. 3 we show these two types of chondrites in a T3/T21 vs. T4/T40 diagram. The chondrites that lost 3He and 4He roughly follow a line through the origin with slope 1 indicating that about the same fraction of the two components of He was lost. The majority of the meteorites shown in Fig. 12 yields, within error limits of ±15%, concordant T3/T21 ages, but some of them have lost radiogenic He. This He loss must, therefore, have occurred before or at break-up of the meteoroid from its

© Lunar and Planetary Institute • Provided by the NASA Astrophysics Data System
parent body, whereas the meteorites with correlated $^3$He and $^4$He deficiencies lost He during their cosmic-ray exposure age presumably by solar heating or a collisional event.

4 Slow neutron fluxes $J$ (30-300eV) were calculated from $^{79}$Br(n, $\gamma$) $^{80}$Kr and fast neutron fluxes $J$ (>5 MeV) from $^{24}$Mg(n,$\alpha$)$^{20}$Ne. Fig. 4 shows that the flux ratio $J_{(\text{slow})}/J_{(\text{fast})}$ strongly increases with increasing slow neutron flux. In meteorites for which we derived a large preatmospheric mass most neutrons are slowed down resulting in a high ratio $J_{(\text{slow})}/J_{(\text{fast})}$.

5 $^{244}$Pu fission $^8$Xe was found in type 5 and 6 ordinary chondrites. The average ratio $^{(134Xe/136Xe)}_t = 0.90 \pm 0.04$ is close to that for $^{244}$Pu fission (0.92 [9]). The time difference between retention of $^{244}$Pu fission $^8$Xe for type 5 and 6 ordinary chondrites and that for Angra dos Reis [10] is 48 ± 30 Ma (Fig. 5). No systematic difference exists, neither between H, L, and LL, nor between type 5 and 6 chondrites for the begin of $^{244}$Pu fission $^8$Xe retention.

Acknowledgements. Work supported by the Swiss NSF.


© Lunar and Planetary Institute • Provided by the NASA Astrophysics Data System