ORDINARY CHONDRITES REDUCED DURING METAMORPHISM. J. T. Wasson, G. W. Kallemeyn and A. E. Rubin, University of California, Los Angeles, CA 90024, USA; R. Whitlock, C. F. Lewis and C. B. Moore, Arizona State University, Tempe, AZ 85281, USA.

Our chemical and petrographic studies show that (the new Mexican chondrite) Cerro los Calvos and Willaroy are H chondrites and Moorabie and Suwahib Buwah (henceforth Buwah) are L chondrites in terms of their compositional and petrographic properties except the degree of oxidation, particularly of Fe. Abundances of Mg, refractory lithophiles and Zn, matrix/chondrule ratios and relative proportions of nonporphyritic chondrules are in the ordinary chondrite (OC) range. Siderophile abundances in Cerro los Calvos and Willaroy are in the H range, as are the mean chondrule diameters (~420 and 320 μm, respectively); Moorabie and Buwah have L levels of siderophiles and larger, L-like chondrules (650 and 540 μm, respectively). For these reasons we refer to them as reduced ordinary chondrites. O-isotope compositions of the four objects are just to the high $\delta^{18}O$ side of the H3 chondrites and to the low $\delta^{17}O$ side of the L3 chondrites.

Although three of the four chondrites are unequilibrated (types range from 3.6 in Willaroy to 4 in Cerro los Calvos), olivine compositions are sharply peaked, and there is no doubt that the chondrites are more reduced than normal ordinary chondrites having the same petrographic (sub) type. Mean olivine fayalite contents (in mol %) are 12.5 in Cerro los Calvos, 14.8 in Willaroy, 15.9 in Moorabie and 14.4 in Buwah. In equilibrated H chondrites the minimum Fa is 17.3 and in equilibrated L is 23.0 mol%.

One of the most important trends observed in OC is that the three groups, and also the individual meteorites, form a continuous siderophile-redox fractionation sequence; they form relatively narrow bands of negative slope on diagrams of siderophile abundance vs. degree of oxidation (e.g., as measured by FeO/(FeO+MgO). It seems unlikely that the oxidation state of the four reduced samples was established in the nebula, i.e., that they represent poorly sampled but "normal" chondritic materials similar to OC but substantially more reduced. Were this the case, we would expect (1) that the amounts and/or compositions of some nebular components would differ sufficiently from those in OC to cause resolvable differences in bulk composition, and (2) that differences in siderophile abundance would correlate with differences in olivine composition.

It seems more likely that the excess reduction of these four chondrites resulted from interaction with foreign, reduced materials during metamorphism; the reduced materials could have been clasts in an OC regolith or the OC materials could have been large clasts in a reduced regolith. Examples of the latter are the reduced OC clasts in Bencubbin and Cumberland Falls. An example of reducing clasts in OC are the C-rich aggregates found in H3.4 Sharps and several other OC. Searches for relict C-rich aggregates have not yet been successful but are continuing. Because the linear dimensions of Moorabie (total mass 14 kg) are only ≈3X greater than those in the largest clasts of the Cumberland Falls chondrite, chemical interaction with a reduced host is physically possible and is currently our favored model.