

THE COMPOSITIONAL CLASSIFICATION OF CHONDRULES AND THE PETROLOGIC TYPE OF AN ESPECIALLY PRIMITIVE H CHONDRITE. D. W. G. Sears, S. Huang, and P. H. Benoit, Cosmochemistry Group, Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville AR 72701, USA.

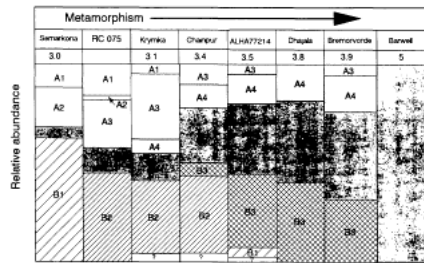
While LL chondrites of petrologic type <3.4 are relatively common, it has been only recently that a few H chondrites of type <3.4 have been reported. One of them is the heavily weathered Roosevelt County (RC) 075 [1]. Weathering and the lack of equilibration make classification uncertain, but it is probably an H chondrite. Weathering also makes it very difficult to assign a petrologic type. For example, removal of the weathering products by acid washing increased the TL sensitivity of RC 075 by a factor of ~7, equivalent to a change in petrologic type estimate from 3.0 to 3.3, a major difference. The compositional classification scheme for chondrules [2,3] summarizes considerably more information than previous schemes [4-6], not least being that it tracks metamorphic effects as well as more thoroughly monitoring primary chondrule differences. It is also very easy to apply and almost 100% of the chondrules can be classified. As an example of its utility, we here show that application of the scheme to the chondrules in RC 075 provides the best means of determining the petrologic type of this highly weathered, but very important, unequilibrated chondrite.

The compositional classification scheme for chondrules divides them into eight classes (A1, A2, A3, A4, A5, B1, B2, B3) on the basis of the composition of the two major phases (phenocrysts and mesostasis) [2,3]. Among the changes that occur during metamorphism, olivines lose CaO and acquire uniform FeO, while the mesostases acquire oligoclase compositions having originally included compositions that were SiO₂ rich (the B series), CaO rich (the A series), and Na₂O rich (A5). These changes give rise to CL

McCoy et al. [1] report means ranging from 0.07 to 7.2 mol% Fa and 0.11-0.36 wt% CaO for olivine in six type-IA chondrules and 12.3-20.2 mol% Fa for five type II chondrules in RC 075 [1]. Four of the type IA chondrules resembled those of Semarkona in olivine composition (<2 mol% Fa). Unlike the compositional classification scheme, which leads fairly simply to unambiguous petrologic type assignment, it seems difficult to assign RC 075 to a petrologic type on the basis of olivine compositions and texture alone. Other advantages of the new scheme are that (1) it applies to individual chondrules and makes no assumptions about average response of chondrules to metamorphism; (2) it is insensitive to brecciation, which is common in UOCs [7]; and (3) it is quantitative, and does not require subjective evaluations of texture, although textural descriptions may be used with the compositional class (just as they are for chondrites).

The compositional classification scheme is certainly subject to improvement (e.g., better compositional boundaries between classes and subdivision of class A5, both in type 3 and higher types). However, as it currently stands the scheme clearly provides the best way of not only describing individual chondrules, but of assessing primary chondrule properties and the extent of changes experienced during metamorphism. Thus it provides the best method for assigning the weathered and highly unequilibrated RC 075 meteorite to a petrologic type and suggests that it is type 3.1. This would make it the lowest petrologic type H chondrite known.

References: [1] McCoy T. J. et al. (1993) *Meteoritics*, submitted. [2] Sears D. W. G. et al. (1992) *Nature*, 357, 207-210. [3] DeHart J. M. et al. (1992) *GCA*, 56, 3791-3807. [4] McSween H. Y. (1977) *GCA*, 41, 411-418. [5] Taylor G. J. and Scott E. R. D. (1983) *Proc. LPSC 14th*, in *JGR*, 88, B275-B286. [6] Jones R. H. (1992) *LPS XXIII*, 629-630. [7] Sears D. W. G. et al. (1991) *Proc. LPS*, Vol. 21, 493-521.



properties that can be used as an alternative to microprobe analysis and that, like microprobe data, are insensitive to weathering. Thus we were able to assign all the chondrules present (almost 100) in a 7 x 5-mm section of RC 075 to compositional classes. The results are shown in Fig. 1, along with similar data from [3]. The relative abundance and classes of chondrules present provides an excellent method of assigning petrographic type. The relative abundance of group B chondrules in RC 075 is less than Semarkona (3.0), and comparable with the higher types, while the abundance of A5 chondrules is comparable to that in Krymka (3.1) and intermediate between that in Semarkona and Chainpur (3.4). Most significantly, the fraction of A1 chondrules is very large and comparable (within error) to that of Semarkona, while the large number of group A3 chondrules is comparable only to Krymka. Apparently, RC 075 is intermediate to Semarkona and Chainpur and comparable to Krymka in its petrologic type.

Sears D. W. G., Huang S. and Benoit P. H. (1993c) The compositional classification of chondrules and the petrologic type of an especially primitive H chondrite. *Meteoritics* 28, 434-435.