PAIRING IN MARTIAN METEORITES RBT 04261 AND RBT 04262: OLIVINE'S STORY S. P. Alpert[1], J. M. Karner[1], R. P. Harvey[1], D. R. Hull[2], [1]Case Western Reserve University Department of Geological Sciences, Cleveland, 112 A. W. Smith Bldg, OH 44106, USA, [2]NASA Glenn Research Center Advanced Metallics Branch, Cleveland, 21000 Brookpark Road, OH 44135, USA.

Introduction: The meteorites RBT 04261 (78.8g) and RBT 04262 (204.6g), were discovered at Roberts Massif in Antarctica during the 2004 field season. The two samples were located 790m apart. Their proximity alone has suggested pairing. Similarly, initial analysis has shown similarities between the major element compositions of the two meteorites [1]. This would generally provide enough argument to prove pairing; however, studies done by Nishiizumi et al. of the cosmogenic radionuclide data indicate that the two meteorites we both distinct objects in space and therefore distinct falls. The study does conclude, however, that the meteorites were from the same ejection event [2].

Analytical Techniques: Two thin sections from each meteorite were used in this study: RBT 04261, 22 and 27, and RBT 04262, 26 and 52. Preliminary analysis was done using a petrographic microscope. Individual grains were identified for further compositional analysis as well comparisons of texture and composition between the two samples. Photos of the samples were taken using a simple digital camera pointed through the objective.

Chemical analysis of the samples was done using the electron microprobe (EMP) at NASA Glenn Research Facilities. Line and single point analyses were acquired to measure the percent oxide values using well-characterized standards. Backscatter electron images were used to analyze texture and mark grains where analysis took place.

Results: For both samples analyses were acquired on both poikilitic and non-poikilitic olivine grains. Some analyses also included areas of pyroxene in order to establish the transition between the mineral grains in poikilitic areas. Both sets of data include between 7 and 10 cumulate grains and 3 poikilitic grains.

RBT 04261: Petrographic analysis shows two distinct zones. Poikilitic zones are primarily comprised of small to medium anhedral olivine grains enclosed in euhedral pyroxene grains. Pyroxene grains also show distinct core to rim zoning. Brecciated zones are mixed olivine and pyroxene with some interstitial plagioclase (maskelynite).

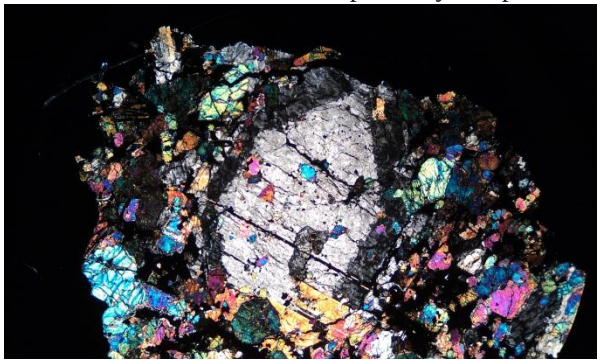

Fig. 1 RBT 04261, 22: image is ~2cm wide

Data collected using the microprobe shows olivine compositional values between 56% and 71% forsterite. Figure 2 above shows the percent forsterite data collected using the EMP for both poikilitic and cumulate areas.

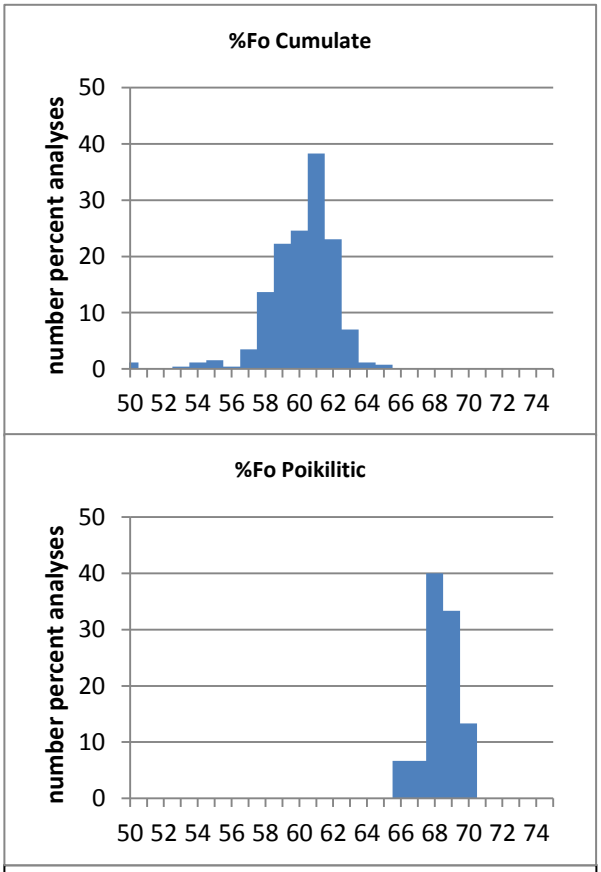

Fig. 2: %Fo for RBT 04261 Olivines, n=356 for cumulate and n=30 for poikilitic

This data shows a clear distinction between the two zones. The data also showed a minor increase in %Fo towards the center of poikilitic grains which was not as pronounced in the cumulate grains.

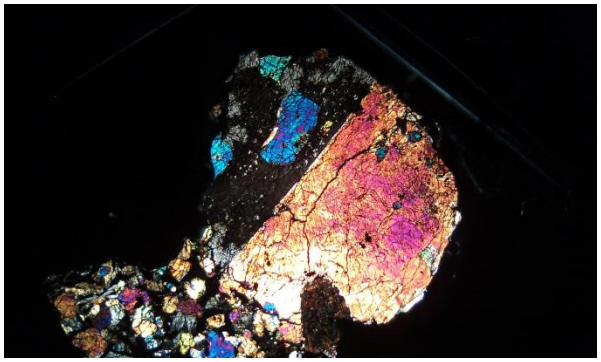

Fig. 3 RBT 04262, 26: image is ~2cm wide

RBT 04262: Petrographic analysis shows two similar zones to RBT 04261: a poikilitic zone and a brecciated zone. The poikilitic zone has medium anhedral olivine grains enclosed in anhedral pyroxene. The pyroxene grains show distinct core to rim zoning. Micro-

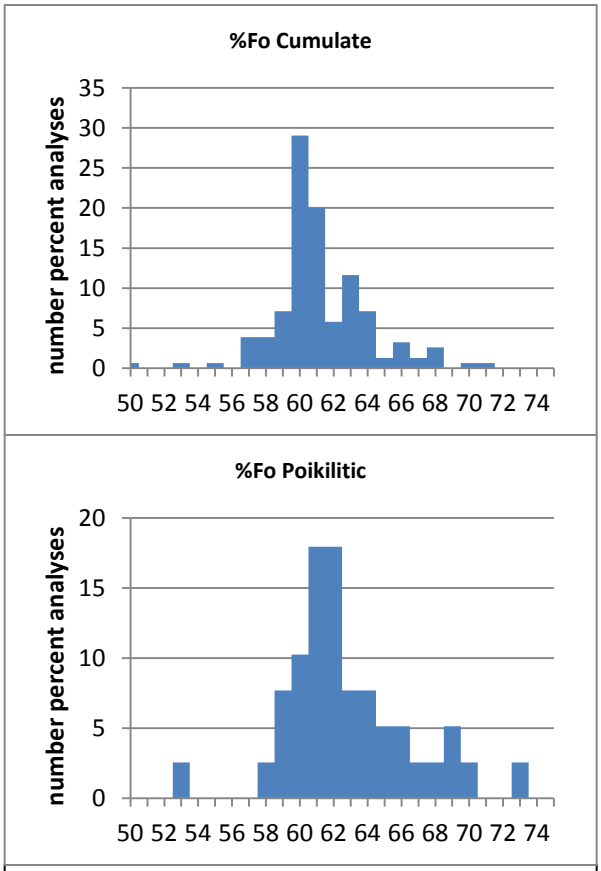

Fig. 4: %Fo for RBT 04262 Olivines, n=155 for cumulate and n=39 for poikilitic

probe data shows slightly different grouping in the percent forsterite for the two zones. As shown in figure 4 above, the range is the same as RBT 04261(between 56% and 71% Fo); however there is more overlap between the two zones as shown in the graphs above. The data also showed that core to rim zoning of the poikilitic grains was more pronounced than that of cumulate grains.

Discussion: Due to the poikilitic areas found in both samples they have been classified as Lherzholites [3] and have been considered paired [3]. Poikilitic areas show significant differences in olivine composition and it is possible that their initial pairing could be called into question. Alternatively, the difference in olivine composition between poikilitic areas may be simply due to the large enclosing pigeonites crystallizing at distinct times and therefore trapping pre-existing olivines of different compositions. A review by Nishiizumi et al. (2010), focusing primarily on the cosmogenic radionuclide data, shows that the two meteorites were distinct objects in space. The same paper also shows that the sum of the exposure dates and the terrestrial dates is the same for both meteorites (2.9Mya), meaning they share an ejection date leaving the conclusion of their pairing an unknown.

References: [1] McCoy T. and Reynolds V. 92007) *Antarctic Meteorite Newsletter*, *30:1*. [2] Nishiizumi K. et al. (2010) *LPS*, *XLI*, Abstract #2276. [3] Papike J.J., et al. (2009) *Silicate Mineralogy of Martian Meteorites*. *Geochemica et Cosmochemica Acta*, *73*, 7443 – 7485.