

ARE MARTIAN METEORITES RBT 04261 AND RBT 04262 REALLY PAIRED? A PETROLOGIC AND GEOCHEMICAL STUDY

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Introduction: RBT 04261 and RBT 04262 were both found in the Roberts Massif (RBT) area in Antarctica by the 2004-2005 ANSMET team. The two meteorites were found 790 m from each other and were the only two achondrites found out of a total of 209 meteorites from that location. Both meteorites are similar in hand specimen having 30-50% black/brown fusion crust with an interior sandy texture [1]. In thin section, the two samples were so similar that a single description was used to characterize them as coarse-grained assemblages of pyroxene, olivine and plagioclase (maskelynite) with minor oxides, sulfides, and melt veins. The two meteorites were paired, and classified as Martian Olivine-phyric shergottites [1].

Recently the two meteorites have been the subject of a cosmogenic radionuclide study to determine exposure histories, terrestrial ages, and ejection conditions from Mars [2]. In short, the authors of this study conclude that the cosmogenic radionuclide data indicate that RBT 04261 and RBT 04262 are not paired, i.e., they were completely different objects in space and hence different falls [2]. Their results are extremely puzzling because the two meteorites were found at the same location, and have similar petrology, mineralogy and chemical composition [2-4]. It would be an extreme coincidence that two Martian meteorites so similar to one another could end up being found on Earth only a mile apart. Therefore we have started a detailed petrologic and geochemical study on several thin sections of both RBT 04261 and RBT 04262, to further evaluate their potential pairing on a mineralogical basis. We note that a comprehensive comparison of both has not been formally done before, as the presumed pairing status of the two meteorites has limited allocations to either one or the other, rather than both.

Preliminary results: We have just started the comparison, but initial optical and electron microscopy show that both RBT 04261,22 and RBT 04262,26 are dominated by areas of equigranular subhedral olivine and pyroxene with lesser lathy to vein-like maskelynite. Chromite and ilmenite are also prevalent in these areas. The two rocks also contain similar poikilitic areas composed of low-Ca pyroxene oikocrysts enclosing olivine and oxides. These observations, along with mineral compositions has led many workers to suggest that the meteorites be re-classified as Lherzolithic shergottites instead of Olivine-phyric shergottites [4-7]. Thus our initial petrographic work reveals the two rocks share a relatively unique and nearly identical mineralogy and texture. The next step in our comparison will be to analyze the major, minor and trace element chemistry of olivine, pyroxene, and maskelynite in both rocks and then compare and contrast the results.

References: [1] McBride K., McCoy T., Reynolds V., Rumble, D. (2007) *Antarctic Meteorite Newsletter*, 30:1. [2] Nishizumi and Caffee (2010) LPSC XLI, Abstract #2276. [3] Sanborn et al. (2008) Goldschmidt Conference Abstracts, A821. [4] Usui T. et al. (2008) *Meteoritics & Planetary Science.*, 43, A159 [5] Mikouchi T. et al. (2008) LPSC XXXIX, Abstract #2403. [6] A and et al. (2008) LPSC XXXIX, Abstract #2173. [7] Papike et al. (2009) *Geochimica et Cosmochimica Acta*, 73, 7443.