Melt Inclusion Analysis of RBT 04262 with Relationship to Shergottites and Mars Surface Composition

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Introduction

- Meteorites provide physical samples of other planetary bodies
- Martian meteorites differ in composition from the Martian surface [1]
- Melt inclusions in the meteorites provide snapshots into magma evolution
- Analysis of RBT 04262's melt inclusions may provide greater understanding of Martian geologic history

Sample and Methods

RBT 04262 (Fig. 1)

- Petrology [2,3,4,5,6,7], Geochemistry [8,9,10], Cosmic Ray Exposure [11,12] studied
- Has a poikilitic and non-poikilitic lithology (Fig. 1)
- Classified as lherzolitic shergottite [2]
- Enriched oxidized end-member of the shergottites [2]

5 RBT 04262 Melt Inclusions studied

- Cameca SX100 electron microprobe at NASA-Johnson Space Center (Fig. 2)
- Modal proportions of phases found with images (Fig. 3)
- Used Petrolog3 to account for diffusive exchange with host olivine [13]

Plotted

- RBT 04262, LAR 06319 [14,15], EETA 79001 [16] and ALH 77005 [17,18] with Martian surface data [1] (Fig. 5, 6, 7, 8)

alphaMELTS

- Run presumed primary magma compositions of Mars [14,19,20,21,22] in alphaMELTS [23,24,25,26,27,28,29]
- Compare melt inclusion data once the filtering has been perfected and 90,000+ runs complete (Fig. 4)

Conclusions

- RBT 04262, LAR 06319 and ALH 77005 melt inclusion compositions overlap with Martian surface compositions (Fig. 5, 6, 8)
- Other melt inclusions are more Si rich, perhaps reflecting more evolved melts (Fig. 5, 6, 8)
- Successful runs of alphaMELTS with filtering may provide greater understanding of the crystallization history of the shergottites

Acknowledgments

Thanks

- Ken Dellinger for his help on the alphaMELTS script
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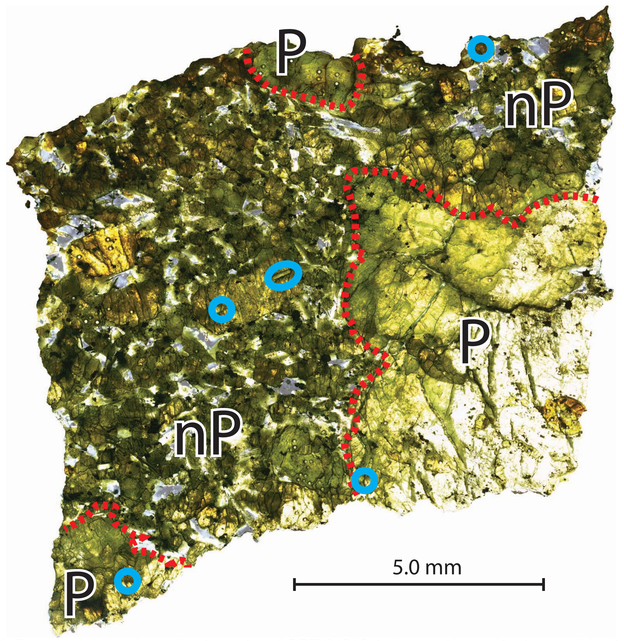

Fig. 1 *Enhanced polarized light photo of RBT 04262 thick section with the poikilitic (P) and non-poikilitic (nP) lithologies outlined by the red dashed line. The non-poikilitic region is characterised by the presence of maskelynite and is finer grained. The melt inclusions analyzed are marked by blue ellipses.*

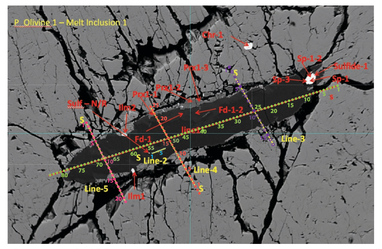

Fig. 2 *Back scattered electron image with the location of the electron microprobe analyses.*

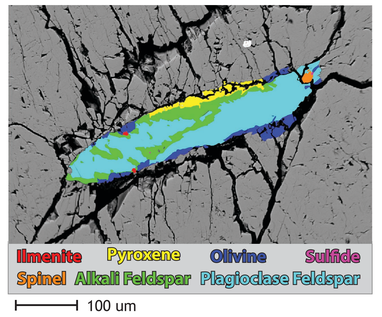

Fig. 3 *Back scattered electron image with areas of various phases marked.*

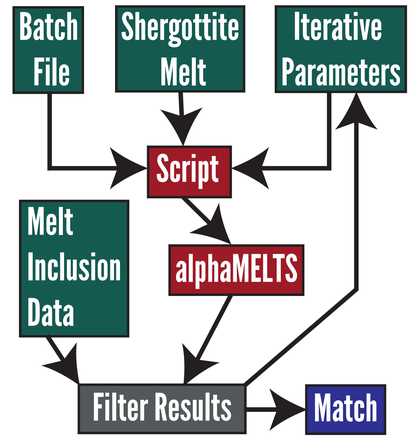

Fig. 4 *Flow chart representing the data progression through the script to compare primary magma compositions to the melt inclusions.*

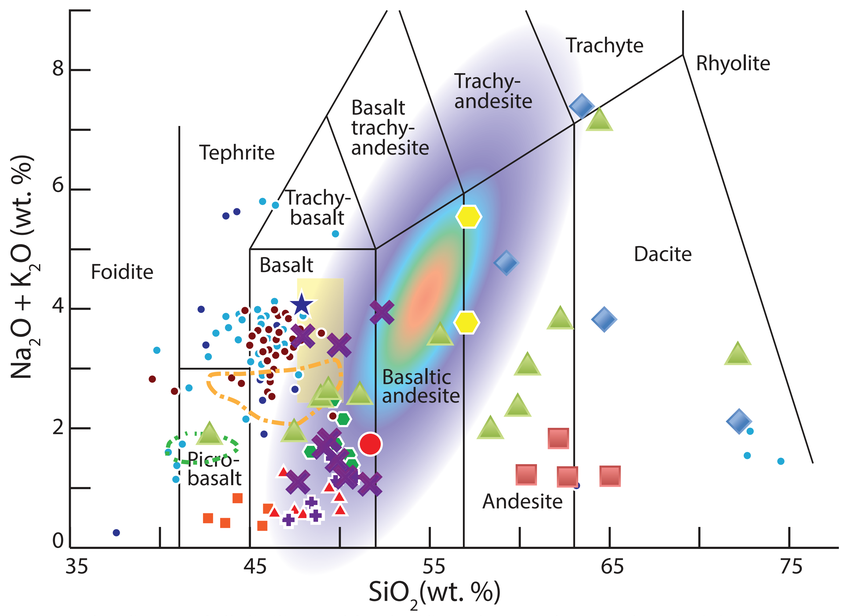

Fig. 5 *Harker diagram of alkali-silica used for classifing volcanic rocks. Note that RBT 04262 and ALH 77005 and some LAR 06319 melt inclusions plot along and near those measurements of Thermal Emission Spectroscopy (TES) of the Martian surface [1]. NWA 7034 can be seen near the TES compositions as well [29].*

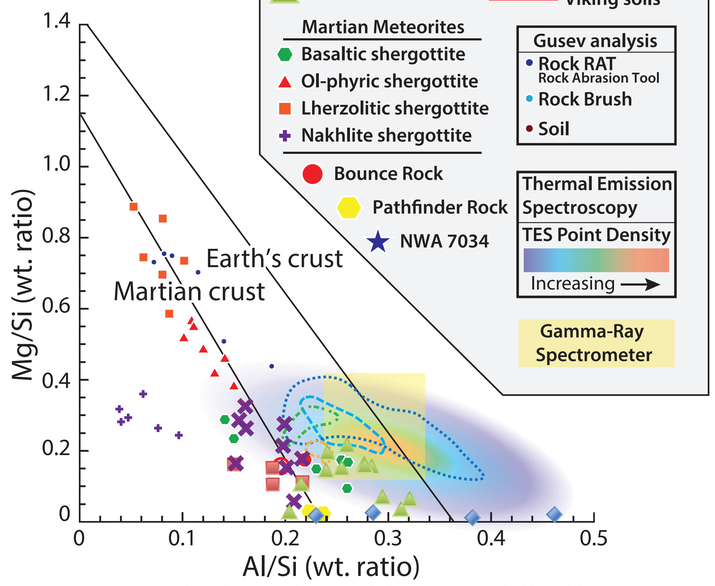

Fig. 6 *Mg/Si-Al/Si diagram showing what was previously thought to be a way to distinguish Mars and Earth rocks [1].*

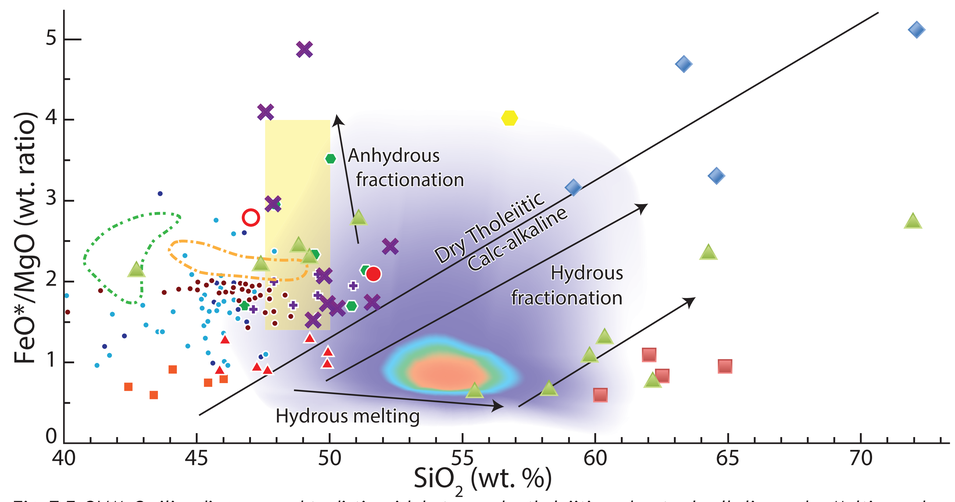

Fig. 7 *FeO*/MgO-silica diagram used to distinguish between dry tholeiitic and wet calc-alkaline rocks. Melting and fractionation trends in terrestrial magmas represented by arrows [1].

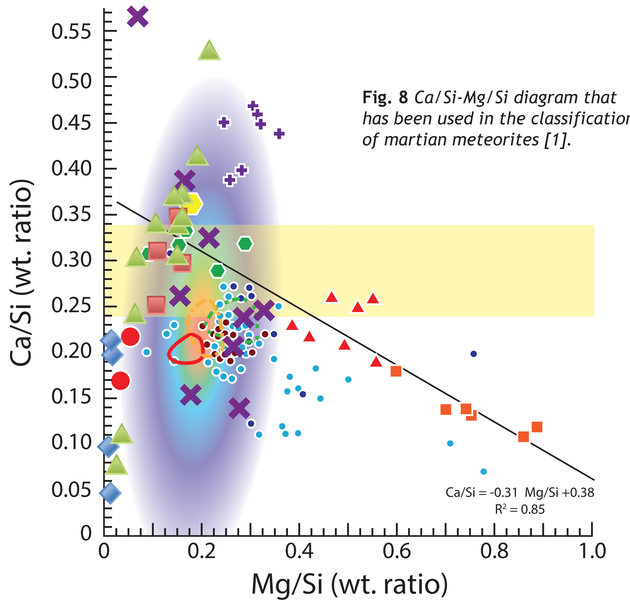

Fig. 8 *Ca/Si-Mg/Si diagram that has been used in the classification of martian meteorites [1].*

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