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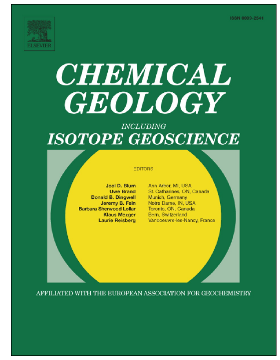

Geochemistry of Martian basalts with constraints on magma genesis

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Geochemistry of Martian Basalts with Constraints on Magma Genesis

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Abstract:

Over the past decade, our knowledge of the geochemical and mineralogical diversity of Martian rocks has greatly increased. Rocks on the surface of Mars are older than most Martian meteorites and have a wider range in bulk chemistry (higher SiO_2, higher total alkalis, and lower MgO contents). Recent Martian meteorite discoveries (NWA 7034, NWA 7635, and NWA 8159) are also significantly older than the Shergottites and NWA 7034 contains clasts which have a similar range in chemistry of the surface basalts. In this invited review, I summarize what is known about the bulk chemistry (major elements) of Martian igneous rocks and use the chemistry to constrain the formation conditions in the interior, and how these conditions have changed through time.

The basalts at Gale Crater are consistent with forming from a metasomatized mantle source which affected not only the chemistry of the basalts, but also the formation conditions. Basalts at Gusev Crater, Bounce Rock at Merdiani Planum, and those basalts not affected by metsomatism like those at Gale Crater have a mantle potential temperature of ~1450 °C for the Noachian. Conversely, Martian shergottites have a much higher mantle potential temperature (~1745 °C), which has always been problematic to explain for such young rocks. New formation conditions calculations are consistent with previous models of formation by a hot mantle plume, but solve the pressure of formation paradox from the previous model. Combining the calculations for mantle potential temperature with previous estimates for GRS measurements of