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Estimating different eruptive style volcanic areas of Mars from NASA Martian Meteorites Compendium data

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The geomorphological characteristics of the Martian surface suggest that both effusive and explosive eruptive behaviour occurred. We investigated whether data about magma viscosity could be extrapolated from Mars SNCs (Shergotty, Nakhla, and Chassigny classes) meteorites, by using available geochemical and petrographic data from the NASA Martian Meteorites Compendium. Viscosity was used to characterize how eruptive style could change in different volcanic regions of planet Mars.
Data about composition and crystallinity of 41 SNCs meteorites were used and classified, avoiding meteorites with poor/incomplete database. We assumed Mars as a one-plate planet, fO_2 = QFM, and H_2O wt% = 0 for each sample. Collected data from the Mars Global Surveyor Thermal Emission Spectrometer (MGS TES) identified the source regions for almost all the studied SNCs meteorites.
As input for thermodynamic simulations we first needed to find the depth and pressure of the magmatic source for each meteorite sample through available Thermal Emission Imaging System (THEMIS). Data about average surface temperatures was used to establish whether a magmatic source is shallow or deep. Successively, we found the magma source depth (and pressure) by using the relationship with the heights of the volcanic edifice. The subsolidus equilibration temperatures found through petrologic softwares were used to calculate viscosity.
Results indicate a crystallization temperature in a range from 1,120°C to 843°C, follow by a variation in viscosity from 101,43 to 105,97 Pa s. Viscosity seems to be higher in Tharsis, Elysium, Amazonis, and Syrtis Major regions than the remnant areas. According to past experimental studies about magma viscosity, we classified the eruptive style into effusive (101-103,5 Pa s), intermediate (103,5-104,5 Pa s), and explosive (104,5-106 Pa s).
The Hellas Basin, Argyre Basin, Ganges Chasma, Eos Chasma, and Nili Fossae regions show an eruptive behaviour between effusive and intermediate, while the Tharsis, Elysium, Amazonis, Syrtis Major, and Terra Tyrrhena regions have a more explosive eruptive style, even if effusive/intermediate activity also occur. Our results seems to be in accord with the Martian geomorphology of the cited areas.