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Water detection in the Martian mantle

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Abstract:

Mars always has been a hot topic in the scientific research field, the most famous theme revolved around the presence of water on this one since it can mean the presence of life on the planet. We have strong evidence about the extinct presence of water on the Martian surface, but what about the Martian interior? Can it also contain water?
In this study we focused on the detection of water in the Martian mantle by using electrical conductivity data. For now, the electrical conductivity profile of Mars is poorly constrained but based on the profiles proposed by Civet *et* al (2014), Vacher *et* al, (2007) and Mocquet *et* al, (2000) we were able to verify if it is possible for the Martian mantle to be hydrous.
We saw that even if the electrical conductivity increases with the iron concentration (Yoshino *et* al, 2012), it is still not enough to explain the actual profile we have from Mars, especially for the bottom of the mantle. By comparing the Arrhenius diagram from our hydrous data with theoretical one for dry Mg#70 olivine and ringwoodite, it is not enough to account for the conductivity-depth profile. In this study we have measured electrical conductivity of hydrous olivine and ringwoodite with Mg#70 at 8 and 16 GPa, respectively. To avoid sample dehydration of samples, the measured temperature range is limited to low temperatures less than 900 K, and found that it is possible to distinguish the presence of water on the electrical conductivity profile all the way to the core-mantle boundary of Mars. The conductivity of both hydrous olivine and ringwoodite are distinctly higher than the dry ones. As mentioned before, the electrical profile of Mars is still poorly constrained, so for now the presence of hydrous olivine in Mars remain uncertain, however our result highly suggest that the Martian ringwoodite is hydrous, with 0.3wt% H_2O, which will correlate the profiles proposed by Vacher *et* al and Mocquet *et* al.

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