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The presence of carbonates on Mars: origin, terrestrial analogues and analytical tecniques ambiguity

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The most common cause of carbonates formation on Earth is the chemical deposition from Ca-rich waters in sedimentary basins, mostly in shallow water. The lack of widespread exposure of carbonates on the Mars' surface in areas where geomorphological and sedimentological mapping confirms the presence of water for a long period of the Martian history, led us to look for a potential different origin of the carbonates identified on CRISM data [1, 2,3]. We suggest the presence of carbonatites on Mars and we have also investigated the capabilities of analytical tecniques for mineralogical analysis to recognise these peculiar type of rocks. Carbonatites are igneous rocks containing more than 50 percent of carbonate minerals and associated silicate minerals as olivine, pyroxene and phyllosilicates. Carbonatites are associated with alkali silicate rocks that are usually of nephelinitic or melilititic affinity. The Martian carbonates are often present in layered rocks and in association with hydrated Fe-Mg silicates (clays family) and kaolinite-group minerals at places [1]. This mineralogical association is very similar to an water-altered carbonatite.

We have compared the compositional and mineralogical affinity of some carbonatite samples from different alkaline-carbonatite complexes from Uganda, Spain and Italy, with the mineralogy described for the carbonate- and phyllosolicate rich rocks on Mars, using the XRD and IR analyses. The mineral assemblage has been defined through petrographic analyses as well. It is important to stress that only with XRD analysis some minerals diagnos-tic of carbonatitic assemblage (i.e. melilite) were identified. The relationships between carbonatites and their associated silicate rocks are complex and are still not fully understood on Earth as well, however, it deserves further investigations to better explain the carbonates and silicate volcanic rocks on Mars and its crustal dynamics.
References: [1] Michalski and Niles, 2010, Nature Geoscience, 751-755. [2] Helmann et al., 2008, Science, 322, 1828-1832. [3] Morris et al., 2010, Science, 329, 421-424.