Alteration mineralogy of Mars: insights from orbit, in situ robotic exploration, and meteorites

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Although it is a very dry place today, the surface of Mars displays ample evidence for past aqueous activity, including in the mineralogical record.
Several decades have passed since the first detection of alteration minerals on the surface of Mars from orbit. Orbital surveys have shown that alteration phases are widespread at the global scale, and their presence in ancient terrains highlights a rich history of early aqueous processes not yet fully understood. In situ missions have provided petrological and geochemical data allowing for the reconstruction of paleoenvironments at the local/regional scale. Together, orbital and in situ observations have revealed multiple complex and long-lived alteration scenarios for ancient Mars.
In the last decade, new instruments deployed on the surface of Mars, including the first X-ray diffractometer aboard the Curiosity rover (2012) and a suite of submillimeter analyzers (SuperCam, PIXL and SHERLOC) aboard the Perseverance rover (2021), have brought new ways to detect, identify and characterize the Martian alteration phases. A whole collection of alteration and primary minerals has been thus identified and used to apprehend the geological evolution of the planet. Our perception of the composition of the martian crust evolved from a simple basaltic planet to the detection of alkaline rocks. . In parallel, the study of Martian meteorites (including the first Noachian regolith breccia) as well as terrestrial analogs has helped to deepen our understanding of the alteration processes that have occurred on Mars.
In this session, we welcome all contributions that tackle the question of formation mechanisms of Martian alteration phases to explain their observed nature and diversity, or that explore their significance to past climates and habitability of the planet.