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Mapping of phyllosilicates NW of Argyre basin (Mars) with Mars Express/HRSC colour data

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The study of Martian mineralogy provides valuable insights into its geological history and environmental conditions over time. One significant aspect of Martian mineralogy is the presence of Fe/Mg-phyllosilicates, also known as clay minerals. These phyllosilicates are important indicators of past aqueous activity on Mars, suggesting the presence of water in its early history. The formation of Fe/Mg-phyllosilicates typically occurs in environments with moderate to low temperatures and near-neutral pH conditions, where water interacts with volcanic rocks or crustal materials containing iron and magnesium. Phyllosilicates make up the majority of aqueously altered minerals on Mars and are widespread on its surface, preferably in ancient Noachian/Hesperian terrains.

Significant amounts of this mineral type have been detected from orbital measurements by the Mars Express/OMEGA and MRO/CRISM spectrometers and are recorded in the Mars Orbital Catalog of Aqueous Alteration Signatures (MOCAAS) [1]. This work concentrates on the substantial Fe/Mg-phyllosilicate deposits that were detected northwest of Argyre Planitia, one of the large impact basins in the ancient terrain of the southern hemisphere of Mars. Despite the wide-spread presence of alteration minerals in this region, no detailed studies have ever been conducted to characterize their geology and chronology.

We investigated the substantial Fe/Mg-phyllosilicate deposits that were detected northwest on Argyre Planitia to shed light on to what extent these hydrated minerals correlate with deposits and structures that were formed by the formation of the Argyre basin, such as impact-induced hydrothermal alteration processes and impact tectonics.

We used remote sensing data (HRSC [2], CTX [3], THEMIS [4], HiRISE [5], MGS MOLA - MEX HRSC Blended DEM Global [6], CaSSIS [7]) to produce a photogeological map with a mapping scale of 1:100,000 and boundaries of 41.5°S to 36.5°S and 298°E to 304°E. The mapping was accomplished on CTX whereas the other dataset were used to validate different surface units. In particular, we used multispectral colour data from HRSC and CaSSIS to discriminate candidate units in terms of their mineralogical composition.

Our region of interest features widespread fractured units that are embayed between two presumably tectonic, scarp-bounded blocks with an elongation approximately concentric around Argye, suggesting a impact-controlled structural history. The unit “fractures_light_tones_plains” and “smooth_light_toned_plain” are considered the main clay-bearing units of interest due to their spatial correspondence with the areas where MOCAAS detected Fe/Mg-phyllosilicates. The region

also displays abundant fractures forming polygonal ground, a characteristic that is typically associated with phyllosilicates elsewhere on Mars.

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