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Detailed mapping of Tempe Terra, Mars: Geology, Tectonic and Stratigraphy of refined units

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Tempe Terra is a plateau of old cratered Late Noachian to Early Hesperian highland materials as well as younger volcanic plains at the martian dichotomy boundary and exhibits a variety of geologic and tectonic features. The combination of tectonic structures and rift related volcanism makes it the ideal investigation area to study crustal processes and their dimension compared to Earth. Previous geologic maps from the mid 80´s have only marginally considered Tempe, so we base our detailed geologic-tectonic mapping on high resolution image data from the HRSC (12.5 m/px) and CTX (5.8 m/px) instruments.
Due to the higher resolution of the HRSC and CTX images when compared to earlier image data (mainly Viking Orbiter data) previously mapped unit boundaries could be refined considerably. Stratigraphic relations especially of the volcanic units could be worked out relatively as well as absolutely via crater size-frequency distributions. Age determination of units with small surface coverage such as single lava flow lobes or debris masses were not possible in the past due to limitations of image resolution. Now this information gap is closed and investigations reveal latest rift related volcanic activity of the Labeatis Mons (37.5N/76W) 822 Ma ago.
Another aspect of this study is the characterisation of the complex fault pattern which cut both the old highland- and parts of the younger volcanic units. Understanding these processes and arranging them into a stratigraphic system provides new insights in the evolution of Tempe and the Tharsis Region nearby.
During our mapping problems arose in particular with the delineation and the specification of units in the eastern part of Tempe due to terrain softening of old highland units. This phenomenon is widely considered to be the result of the viscious creep of a near-surface layer of ice-rich permafrost within the Martian megaregolith whereby the surface is leveled by degrees. A further indication are permafrost depressions and flow structures within the heavily cratered units possibly formed as a result of melting of an ice-rich layer and subsequent degradation.