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Comparative hydrological study of two Martian paleolakes (9°34'00"S-167°11'00"W and 10°12'00"S-165°38'00"W) located in Mars Memnonia quadrangle

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In this work we present the hydrological reconstruction of two Martian paleolakes located in the Memnonia quadrangle between 164°0'0"W and 169°0'0"W longitude and between 7°0'0"S and 12°0'0"S latitude. Both paleolakes formed in ancient craters excavated in Noachian terrains: the crater rims of both lakes are cut by tributaries and outlets, which are interconnected through a wide riverbed network.
The first paleolake is located inside a crater centered at 9°34'00"S latitude and 167°11'00"W longitude, and whose radius ranges between 9.6 and 11.4 km while the elevation spans between -486 and -1803 m. After creating a bathymetric map, we measured the ancient water level, WL, of the paleolake, i.e. -1409 m, taking into account the outlet's elevation. The paleolake area A0 at the WL, was 164.7 km2 with a total water volume VW of 10.9 km3. The paleolake floor mean elevation is at -1480.4 m, giving a water mean depth of 71 m. By following Garvin et al [2003] law presented by Schon et al., [2012], we derived a sediment thickness range between 850 and 990 m.
The second paleolake is inside a crater at 10°12'00"S latitude and 165°38'00"W longitude. It is larger than the first one, with a radius that spans between 41.31 and 49.70 km and whose elevation ranges between -330 and -2179 m. The ancient water level, WL, of the paleolake is at -1420 m, giving an area A0 of 4734.6 km2 measured at the WL, and a total water volume VW of 1264.7 km3. The paleolake floor mean elevation is at -1695.7 m, giving a water mean depth of 276 m and a predicted sediment thickness range filling the crater floor between 2190 and 2490 m.
The thickness of the sediments is comparable to sediment thickness of terrestrial crater lakes; if the sediments are all of lacustrine origin, then climatic conditions that allowed water to stay in liquid form on the planet surface may have lasted for hundredth of thousands to million of years.
A comparison between the two paleolakes indicates that the first one has reached a more developed sediment filling degree of maturity.
We are also going to present multiple lacustrine parameters we derived for both paleolakes in order to make comparisons between terrestrial and Martian paleolakes; amongst the parameters are the relative depth, the shoreline length, the shoreline development and the volume development (Hutchinson [1957] and Wetzel [1991]), showing that these values are similar to those derived from Crater Lake in Oregon (Hutchinson 1957).
Indications about the discharge of the tributaries and the outlets are also presented. Moreover, we are going to show our investigation of the two paleolakes timescale formation made possible through the use of different sediment transport models.
The analysis we performed was made possible by the ESA Mars Express - High Resolution Stereo Camera, MEX-HRSC, visible and infrared images (resolution of 12.5 m) and Digital Elevation Models (DEMs) with a resolution of 75 m, and where there was no High-res DEM coverage, with the Mars Global Surveyor - Mars Orbiter Laser Altimeter, MGS-MOLA, DEM with a resolution of 460 m.