CALCULATION AND PREDICTION OF HYDROTHERMAL ZONES AND IMPACT CONDITIONS ON ARGYRE PLANITIA, MARS.

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Synopsis: Argyre Planitia, named in 1973, is among one of the largest impact basins on Mars with a diameter of about 868 km, Argyre is located at S49.4 deg and W42.8 degrees. Argyre was part of a larger surface hydrological system (the Chese Trough Sanders, 1979) that also included two large valley networks draining the Margaritifer Sinus region northwest of Argyre. The morphometry of these systems suggest a combination of precipitation and groundwater sapping, with surface runoff for their formation (Grant and Parker 2002) [1], distributions of dust devil track has been studied on Argyre too [2]. This work is an application of mathematical models [3] for the determination of impact conditions, and for the prediction of possible hydrothermal zones generated after of the impact. All the calculations are obtained using a HP 49g, which is Scientific Programmable Graphing Calculator with 1.5 Mb in RAM memory.

Analytical Method and Results: According this model [3] the asteroid diameter is ~ 307.55 km, with a velocity and impact angle of ~ 14.69 km/s and ~ 74.33° respectively. The number of rings are calculated in ~ 294.11 with a crater profundity of ~ 5.40 km and melt volume of ~ 3,185,768 km³. The number of ejected fragments are estimated in ~ 1.14E14 with sizes of ~ 6.35 m. The total energy in the impact is calculated in ~ 1.56E33 Ergs, i.e., ~ 37,085 millions of Megatons. Before of the erosion effects the transient crater is estimated in ~ 581.85 km, the hydrothermal zone (hydrothermal systems) is of ~ 182.26 km to 290.93 km from the nucleus of impact. The lifetimes estimated are of ~ 47.74 Ma to 74.52 Ma with uncertainties of ~ +/- 1.3133% to +/- 3.5391%, i.e., from +/- 0.63 Ma to +/- 1.96 Ma. Hydrothermal temperatures from 0.25 years to 1,400 years are estimated in ~ 320°C to 125.64°C (epithermal). The fragments are ejected to ~ 4,605.66 km from the impact center, with a velocity of ejection of ~ 4.79 km/s, ejection angle of ~ 24.21° and maximum height of ~ 517.79 km.

Conclusions: The numerical predictions for hydrothermal systems on Argyre, shows possible Kat thermal (~ 320°C) and Epithermal (~ 125.64°C) activity inside of the crater in the interval [182.26 km , 290.93 km]. Hydrothermal systems have long being proposed as good candidates for niches of life, the impact genesis of Argyre may have produced such environment conductive to life.

References: [1] Parker T. J., Grant J. A., Anderson F. S., and Banerdt W. B., (2003), Sixth International Conference on Mars, 3274.pdf. [2] Whelley P. L., Balme M. R., and Greeley R., (2003), Lunar and Planetary Science, 1769.pdf. [3] Echaurren J., and Ocampo A.C., (2003), EGS-AGU-EUG Joint Assembly.