A MATHEMATIC MODEL FOR THE MONTURAQUI IMPACT CRATER, CHILE, SOUTH AMERICA. J. C. Echaurren[1], A. C. Ocampo[2] and M.C.L. Rocca[3], [1]Codelco Chuquicamata, Chile, jecha001@codelco.cl , [2]NASA-Jet Propulsion Laboratory, Pasadera, CA, USA, , [3]Mendoza 2779-16A, Ciudad de Buenos Aires, Argentina, (1428DKU), maxrocca@hotmail.com . This work was partially funded by The Planetary Society, CA, USA.

Synopsis: The Monturaqui impact crater, Atacama, Chile (S23º56' W68º17') is a simple-type impact crater and was discovered in 1962 by examination of aerial photographs. Later, in situ geologic research confirmed its meteoritic impact origin. Diameter: 460 meters, Depht: 31 meters. The crater lies in an area of desert hills of the Monturaqui range and it is located in the high Atacama Desert (altitude of 3500 meters). The Monturaqui crater is emplaced in Jurassic granite rock, overlain by a thin Tertiary-Quaternary ignimbrite sheet.

The impacting asteroid was metallic: an Iron-Nickel object. Meteorite specimens have not been recovered, but, meteoritic iron shale was found on the outer rim of the crater and highly vesicular impact glass material was abundont on the South and SE flanks of the crater. The impactites have shocked minerals and rock fragments as well as tiny Fe-Ni-Co-P sherules, all bound in glass.

Analysis of the mixed matrix glasses indicated extreme compositional differences compared to granite country rock. Glass shows enrichment in Fe, Ni and Co. These metallic elements came from the impacting metallic asteroid no doubt. The age of this crater has been estimated in about 1 Ma, [1, 2].

The mathematical model is applied in quantum formalism, polynomial elements and Korteweg-DeVries (KDV) soliton theory [3], using a HP 49g, which is a Scientific Programmable Graphing Calculator with 1.5 Mb in RAM. For the impact event are used the following parameters: diameter ~ 460 meters, circular shape, basement composition ~ granitic.

Analytical Method and Results: According this model [3], the asteroid diameter is ~ 14.92 m, with a velocity and impact angle of ~ 17.82 km/s and 41.12° respectively. The number of rings are calculated in ~ 0.21 with a initial crater profundity of ~ 53.85 m, this quantity could be altered across the passage of time to ~31 m, the melt volume is ~ 6,763,699 m^3 or ~ 0.0068 km^3. The number of ejected fragments are estimated in ~ 7,401.1 with average sizes of ~ 0.77 m, and a cloud of dust with diameter of ~ 23.61 km. The total energy in the impact is calculated in ~ 4.77E22 Ergs, i.e., ~ 1.14 megatons. Before of the erosion effects the transient crater is estimated in ~ 226.43 m, the hydrothermal zone (hydrothermal systems) is of ~ 14.92 m to 113.21 m from the nucleus of impact. The lifetimes estimated are of ~ 2,244 years to 3,503 years with uncertainties of ~ +/- 0.9639 % to +/- 2.7286 %, i.e., from +/- 22 years to +/- 96 years. Hydrothermal temperatures from 0.25 years to 1,400 years are estimated in ~ 97.95°C to 21.79°C respectively. The fragments are ejected to ~ 11.49 km from the impact center, with a velocity of ejection of ~ 1.12 km/s, ejection angle of ~ 2.58° and maximum height of ~ 129.59 m. The density of the asteroid is calculated in ~ 6.31 g/cm^3 and the combined density (maximum and minimum) for the ejected fragments is estimated in ~2.63 g/cm^3. Finally, the temperature peak in the impact is estimated in ~0.76 times the temperature of the solar nucleus, by a space of time of ~ 0.09 ms ~(9E -5 s).

References: [1] Sanchez J. And Cassidy W. (1966) Journal of Geophysical Research 71: 4891-4895. [2]Bunch T and Cassidy W. (1972) Contributions to Mineralogy and Petrology 36: 95-112. [3] Echaurren J., and Ocampo A.C., (2003), EGS-AGU-EUG Joint Assembly, Nice, France.