EVIDENCE OF NON IMPACT CRATERING ORIGINE OF IMILCHIL (MOROCCO) LAKES (ISLI AND TISLIT). S. Chaabout[1], H. Chennaoui Aoudjehane[1], W.U. Reimold[2,3], M. Aboulahris[1], M. Aoudjehane[4], [1]Hassan II University Casablanca, Faculty of Sciences Aïn Chock, GAIA Laboratory, BP 5366 Maarif, Casablanca 20000 Morocco, [2]Museum für Naturkunde Berlin, Invalidenstrasse 43, 10115, Berlin Germany, [3]Humboldt – Universität zu berlin, Unter den Linden 6, 10099 Berlin, Germany, [4]302 Boulevard Panoramique, 20150 Casablanca, Morocco. (chaabout_souad@hotmail.com), (chennaoui_h@yahoo.fr).

Introduction: Isli and Tislit in the Imilchil region are two widely known lakes in Morocco. Local legend tells that these lakes were formed from the tears of separated lovers. The origin of these depressions has been discussed by some researchers [1,2] in terms of three processes: formation of a karstic depression, syncline formation, or meteorite impact. The most widely considered mode of origin is due to tectonic effects related to syncline formation.

In 2012, newspapers in Morocco reported the presence of two impact craters (Isli and Tislit) related to the Agoudal iron meteorite find. These meteorites have been found about 20 km from these lakes though [3,4]. In order to investigate this impact hypothesis, we organized a field mission to Imilchil area during May 2013.

Geographic localisation: Isli is one of the largest and deepest natural lakes in North Africa with 2.55 km^2 surface area and 95 m depth. It is located in the central part of the Moroccan High Atlas, 9 km NE of Imilchil town. Tislit is located about 8 km to the W of Isli and is a smaller lake, with a surface area of 1.3 km^2 and a comparatively reduced depth of about 16 m [1].

Geological setting: The Imilchil area is a part of the Moroccan High Atlas, the most elevated part of the intracontinental belt of Northern Africa. The Isli and Tislit lakes are located on the "Plateau des lacs" that is an Upper Paleocene / Lower Eocene perched syncline, developed in between Mesozoic elongated and narrow anticlinal ridges (Tassent Ridge and Msadrid Ridge) trending SW-NE. The lakes occur in the core of these syncline-topped anticlinal ridges (STARs) [2,5]. The core of the syncline is formed by the Bathonian (Middle Jurassic) Anemzi Red Bed Series made up of sandstone and shales, superposed onto Bajocian marly limestones that, in turn, cover Reef limestones of the Agoudim Series [5].

Field observation: The "Plateau des lacs" syncline is trapped between two important faults trending N70°, related to the Tassent and Msadrid ridges, with a sinestral movement. Numerous smaller faults essentially perpendicular to N70° were found at many places around Isli lake. The Isli lake is located within alternating bars of biodetrital limestone rich in corals, brachiopods and green marl increasingly thickening upward, of the middle and upper Bajocian [4]. Tislit lake is more recent than these rocks and likely its formation was initiated with the development of an angular unconformity between the Bajocian and Bathonian stages, with alternating calcareous sandstone, red sandstone, silt and clay deposition. Both lakes have dolerite intrusions crossing all layers that likely relate to a post Jurassic regional magmatism.

Our observations include:

- There is no elevated crater rim at either structure.
- The layers surrounding the lakes are not overturned.
- Pre-lake strata dip inward towards the lake center.
- The lake shores are sites of thick sub-horizontally, often cross-bedded lake terraces. In other places, the shallowly inward dipping beds forming the base of the syncline can be followed right into the shoals.
- No radial or concentric fault trends have been observed; all fault structures measured are related to the main faults surrounding the syncline,
- We observed perfectly preserved ripple marks in recent and older sedimentary deposits around the lake.
- No meteorite samples have been found around or close to the lakes.
- No shatter cones were noted.

Conclusion: This recent expedition showed that

- There are no shatter cones in evidence; the lithologies are currently being thin sectioned to investigate the alleged presence of shock microdeformation.
- No samples of the Agoudal iron meteorite (or any other meteorite) have been found close to the lakes.
- Results of our mapping around the lakes proved that there is no significant rock deformation surrounding the lakes that could be linked with a cataclysmic origin of these two structures.

Our results do not favor an impact origin of Isli and Tislit lakes. The local geology is consistent with a formation of the lakes within a synclinal basin as a result of tectonics, as already published [1,2,5].

Acknowledgments: The field work has been supported by the Barringer Crater company, the program CMIFMP Volubilis (MA/11/252), and CNRST-Morocco and CNRS-France, PICS (SDU 01/10). WUR's research is supported by the DFG (Deutsche Forschungsgemeinschaft).

References : [1] Zeroual E. (1995), Ph.D. Thesis, Neuchâatel University, Switzerland 191 p. [2] Ibouh H. (2004), Ph.D. Thesis, Cadi Ayyad University, Morocco. [3] Garvie L. et al. (2013), Meteoritics & Planetary Science 48. [4] Chennaoui H. et al. (2013), Meteoritics & Planetary Science 48, Abs. [5] Michard A. et al. (2011), Terra Nova, 23, 314–323.