

A FRENCH-MOROCCAN PROJECT FOR THE STUDIES OF IMPACT PROCESSES ON THE EARTH AND THE MOON. D.Baratoux¹, H. Chennaoui-Aoudjehane², F. Colas³, Z. Benkhaldoun⁴, A. Jambon⁵, A. Leroy⁶, P. Lognonné⁷, O. Azagrouze⁴, M. Ait Moulay Larbi³, S. Bouley³, A. Bounhir⁴, M. Calvet¹, S. Chaabout², S. Chevrel¹, A. Daassou⁴, R. Garcia¹, A. Habib⁴, A. Jabiri⁴, N. Larouci², P. Pinet¹, M. Sabil⁴, J. Vaubaillon³. ¹Université de Toulouse, UPS-OMP; IRAP; Toulouse, France (david.baratoux@irap.omp.eu). ²Hassan II University Casablanca Faculty of Sciences - Department of Earth Sciences, Casablanca, Maroc. ³Observatoire de Paris, Institut de Mécanique Céleste et de Calcul des Ephémérides, Paris, France. ⁴Laboratoire de Physique des Hautes Energies et d'Astrophysique, Université Cadi Ayad, Marrakech, Maroc. ⁵Laboratoire ISTeP, Université Pierre et Marie Curie, Paris, France. ⁶Uranoscope de France, Paris, France. ⁷Institut de Physique du Globe de Paris, France.

Introduction: Collisions affect all the bodies of our solar system and impact cratering is now regarded as a major geological process controlling the evolution of solid planets, including the Earth. In particular, the knowledge of the terrestrial impact crater record is far from being complete. However, this field of research is not equally considered in the world, a situation which can be addressed by more international collaborations involving geologists, planetary scientists and astrophysicists. Morocco appeared to be one the most favorable places in Africa to promote the development of impact science. It has a large proportion of deserts landscape, offering of fantastic terrains for meteorite recovery, and active researchers in this field, contributing through the studies of primitive and differentiate objects to the reconstruction of the solar system history. Morocco has also one of the major astronomical observatories in Africa (Fig. 1), which recently drew attention with the findings of a Near-Earth Object and two comets in the frame of the MOSS project (Moroccan Sky Surveyor) [1]. Considering these major assets, a group of 22 researchers were funded in 2011 for a three years scientific partnership between France and Morocco. In coincidence with the project concept, the project leader belongs to a laboratory (IRAP) which was recently created at the interface between astrophysics and earth sciences. The three research directions and first results are presented here.



Fig. 1 - University Cadi Ayyad Oukaimeden Observatory (350 mm and 600 mm telescopes, remotely controlled from Marrakech).

Observation of impact flashes on the Moon: A first research axis was conceived in the context of the seismological exploration of the moon. About 1/5th of the seismic events recorded by Apollo seismometers were impact events. These impacts may be now detected

from medium-sized telescopes from the Earth transient luminous events (impact flashes). New mission concepts for the seismological exploration of the moon include systematically this revolution in lunar seismology, and call for ground-based stations dedicated to impact flash monitoring, providing time and location of each event [e.g., 2,3]. The Oukaimeden observatory is now one of the few places in the world with the necessary material for the observations, and several researchers familiar with the techniques of observations of impact flashes [4]. Progresses in understanding the nature of the transient luminous events were notably realized during an observation campaign in Morocco and published in *Icarus* early this year [5].

Meteorite recovery and analysis: Meteorite recovery is very active in Morocco, especially in the deserts south. Several projects for classification and scientific valorization of meteorite collections of the country are led by H. Chennaoui in Casablanca [e.g., 6]. This research was recently highlighted by the fall of a Martian meteorite in Tissint.

Search for impact craters in Morocco : Deserts of the African continent are also well known for some of the most spectacular impact structures. The organization of the second AICAC meeting in Casablanca, promoting impact science in the Arab world illustrates the rising interest for impact science in Morocco [7]. However, impact structures in Morocco are yet to be discovered. An exploration program was initiated, using first satellite imagery for the identification of potential structures. A follow-up field campaign was achieved in 2011, with at this stage negative results presented at AICAC II. This research is also supported in the frame of the partnership by a class of master students in Toulouse currently achieving a systematical search for circular structures in Morocco [8].

References: [1] Benkhaldoun, *this issue*. [2] Mimoun et al. (2011) *Experimental Astronomy*, doi:10.1007/s10686-011-9252-3. [3] Yamada et al. (2011) *Planet. Space Science*, 59, 343-354. [4] Bouley et al., *this issue*. [5] Bouley et al., *Icarus*, 218, 115-124. [6] Larouci et al. (2011) AICAC, Casablanca, [7] Baratoux et al., submitted to *Journal of African Earth Science* [8] Baratoux et al., *this issue*.