CURRENT STAGE OF THE CIRIR RESEARCH AND OUTREACH AT ROCHECHOUART. P. Lambert. 1 CIRIR-Center for International Research and Restitution on Impacts and on Rochechouart-87600 Rochechouart-France, lambertbdx@gmail.com.

Introduction: On August 14, 1969, Mrs Boulesteix, landowner near the center of the Rochechouart structure guided François Kraut and Bevan French on her property to what she understood what these gentlemen were seeking: “shatter cones”. This is how Rochechouart entered into the family of terrestrial impact structures, after F. Kraut presented the finding at the French Academy of Sciences in October of the same year [1]. Following the recognition of the heritage value of the site by the State in 2008, the “Réserve Naturelle Nationale de l’Astroblième de Rochechouart-Chassenon” was inaugurated in 2009 in Rochechouart to protect 12 of the most significant outcrops. Eventually 2019 is also the 5th anniversary of the launch of the “Mission to Rochechouart”. This is a project presented at the Meteoritical Society Meeting in Casablanca [2] for achieving the objective announced in 2008 at the LMI IV conference in Vredefort [3], i.e., developing active research on Rochechouart (that remained at the exploration stage since its recognition as an impact structure), and promoting the site as a natural laboratory open to research and education – worldwide, for ground truth data mining of impact cratering information and on the collateral effects on planetary surfaces. Despite a remarkable accessibility and the richness of the geological record (see [2-4]), a major drawback for achieving this goal at Rochechouart has been the vegetation cover. Inspired by Apollo, the means proposed in Casablanca for overtaking this limitation and for mobilizing the community worldwide on Rochechouart were to i) realize a first drilling campaign within the geosite, and ii) make the cores available to the world community via a dedicated storage facility on site and an organization to facilitate and coordinate research [2].

Results: Thanks to the support of the local district councils, the State, and a number of scientists who endorsed these two complementary projects, CIRIR (Center for International Research and Restitution on Impacts and on Rochechouart) was created in 2016 and the drilling program was undertaken in 2017-2018. A total of 8 sites were drilled delivering over 540 m of core [5-6]. In parallel, CIRIR has grown by associating individuals and organizations (currently over 70 scientists from a dozen countries) who take advantage of the geosite, the geomaterials, the facilities on site, and the group itself for carrying out projects of their own. They all contribute to the empowerment of the impact geoheritage to the mutual benefit of the scientific community, the geoheritage, the Reserve, and the public at large (see below). The combined effort forms the CIRIR program currently counting 60 research projects covering essentially all impact-related topics [5-6]. All applied geophysics in France has joined CIRIR and teamed up for testing and developing technologies using Rochechouart as a test site and the drill core as reference material, resulting in a better understanding of the structure itself (see presentations at the Conference by [7-9]). Projects unrelated to the cores and/or not requiring core samples have started and already resulted in a significant increase in the bibliographic record on Rochechouart within the last 5 years [5-6]. The detailed studies on the drill core will start soon. The first series of samples requested by CIRIR PI’s will be delivered in the fall of 2019. Yet the preliminary investigations related to the cores have already led to major results regarding the size and morphology of the initial crater (> 50 km-peak ring), the paleogeography (influence of the sea), and the related distal and local effects (tsunami) ([5-6]). In parallel, the CIRIR facility has been installed at Rochechouart. It is composed of two units. One is designed for accommodating and managing the cores and also the surface samples (see before). CIRIR has proposed the idea endorsed by the prefectures to install a scheme similar to that for archeology on the impact territory at large. When a hole is dug and the bed rock is reached, CIRIR will be informed and will collect a sample for conservation before the temporary outcrop is destroyed or masked by construction. As for meteorite finds, the population within the impact area at large will be invited to contribute by reporting their own observations and findings. This citizen science program serves both the interest of science and the public. It enriches the sample library, and raises the level of scientific awareness amongst the public. It is also a factor of social cohesion by adding pride and self-esteem to the population.

All samples will be managed, curated and made available to the community worldwide by CIRIR (“impact on shelf”) [5]. The main practical requirement for building up such a “dynamic” sample library is space for storage. The community of communities “Porte Océane du Limousin” (POL) already provided the land and 2 buildings for storage in the center part of Rochechouart. A third building next to the sample library provides housing and office facilities for up to 10 guests. It will be completed in late 2019. A linked
lodge unit located 12 km from Rochechouart is also part of the CIRIR facility. It can accommodate up to 50-60 people in 16 chalets. With the support of the State and local communities, POL invested nearly 0.5 M€ in the construction and equipment including a laboratory for sample preparation and for optical studies. These facilities are open to visiting scientists, students and professionals coming to take advantage of the sample library and/or the field itself, and/or the presence of CIRIR members for their research and/or training. The facilities are maintained by public money and are available at no charge as part of a “world public service” for promoting the Rochechouart geosite and impact science in general. Samples and the field are the “heritage”. They belong to the site and to Humanity. The community worldwide has the responsibility to both protect and make good use of this heritage. CIRIR and the Natural Reserve are the instruments on site for achieving this goal. In this context sample curation and sampling of the Rochechouart impact structure require a minimum formalism by CIRIR (and the Reserve when it applies), by signing an agreement regarding the use, the tracking and the restitution of the sample(s), the material being thus available for further studies by other users. The next call for samples is open until Spring 2020 when a batch sample allocation process will take place, the same scheme being repeated each year.

Beyond research, the CIRIR program and teams expand into education and outreach including geoconservation and geotourism. The aim is empowering the science achieved at Rochechouart and on impact cratering in general, and the human adventure that goes with it, and to make it profitable for the public at large. Owing to its accessibility and exposure, the Rochechouart impact structure is a unique site for field learning and for experiencing all scientific and practical issues related to large impacts on Earth and on other planetary surfaces (Moon and Mars in particular). The whole planetary geology course of the 3 leading universities in Belgium, representing a group of 40, has already taken advantage of the CIRIR facility for field training. Several similar projects are planned in France and in the wider EU. More will develop with the propagation of the research on Rochechouart into the academia worldwide. On a practical geological ground, the prospect of utilizing the Moon and near-Earth Asteroids for resource targeting is appearing on the agenda of several space agencies and of private companies. In this context, together with a former space mission director at ESA, who has joined the CIRIR Restitution team, we propose Rochechouart and the CIRIR facilities and means, to Space agencies, and concerned industries, for education and training and for developing technologies related to prospecting and exploiting impact materials [17]. Locally, CIRIR directly contributes to sustainable development. Its activity on site gives an unprecedented visibility to the region and its impact workers. The aura of the topic and the quality of visitors from other countries benefit tourism and the population. CIRIR activities also directly serve the other structures and initiatives linked to natural heritage, such as the National Reserve, the Regional Park (Parc Naturel Régional du Périgord-Limousin), and the local tourist offices. For instance, CIRIR provides the Reserve, at no cost, with the legitimacy and the expertise for achieving one of its primary missions - characterizing the geological heritage on its territory as illustrated by the installation of the first drilling campaign by the CIRIR in 8 of the 12 sites of the Reserve. Inversely the Reserve benefits CIRIR and the scientific community. It funded the 2017-2018 drillings with the help of the State and the local communities. Such a win-win relation is a key factor of the CIRIR strategy for setting up and implementing its Research and Restoration programs. Another example is Cassinomagus, a world-class gallo-roman archeological site comprising thermal baths, aquaduct, temple, and other constructions that are entirely made in impacite. The outreach structure (archeological park) and the archeology research center on site have both joined the CIRIR teams, each benefiting from the aura, skills and information of the others, in their own field. CIRIR is also contributing to a project led by a local association for installing a planetarium on site and offering the tourists and populations training on stars, meteors, meteorites, and impacts. At the national and international scales CIRIR leads an ambitious project intended to boost the attractiveness of the site and to facilitate all initiatives and projects, including science, by proposing the Rochechouart asteroid impact and its distal effects at various places in Europe, to the World Heritage list (CIRIR-UNESCO project).

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