

**CIRIR PROGRAMS: DRILLING AND RESEARCH OPPORTUNITIES AT THE ROCHECHOUART IMPACT STRUCTURE.** P. Lambert<sup>1</sup>, Alwmark C.<sup>2</sup>, Baratoux D.<sup>3</sup>, Brack A.<sup>4</sup>, Bruneton P.<sup>5</sup>, Buchner E.<sup>6</sup>, Chevremont P.<sup>7</sup>, Claeys P.<sup>8</sup>, Dence M.<sup>9</sup>, Floch J.P.<sup>10</sup>, French B.<sup>11</sup>, Gattacceca J.<sup>12</sup>, Gibson R.L.<sup>13</sup>, Goderis S.<sup>14</sup>, Grieve R.<sup>15</sup>, Hodges K.<sup>16</sup>, Hörz F.<sup>17</sup>, Jourdan F.<sup>18</sup>, Kelley S.<sup>19</sup>, Kenkmann T.<sup>20</sup>, Kring D.<sup>21</sup>, Langenhorst F.<sup>22</sup>, Lee M.<sup>23</sup>, Lindgren P.<sup>24</sup>, Lofi J.<sup>25</sup>, Lorand J.P.<sup>26</sup>, Luais B.<sup>27</sup>, Masaitis V.<sup>28</sup>, Meunier A.<sup>29</sup>, Moore C.<sup>30</sup>, Ormo J.<sup>31</sup>, Osinski G.<sup>32</sup>, Petit S.<sup>33</sup>, Pohl J.<sup>34</sup>, Quesnel Y.<sup>35</sup>, Reeves H.<sup>36</sup>, Rochette P.<sup>37</sup>, Sapers H.<sup>38</sup>, Schmieder M.<sup>39</sup>, Schultz P.<sup>40</sup>, Schwenzer S.<sup>41</sup>, Shoemaker C.<sup>42</sup>, Stöffler D.<sup>43</sup>, Trumel H.<sup>44</sup>, Westall F.<sup>45</sup>, Wittmann A.<sup>46</sup>, and Wuennemann K.<sup>47</sup>. <sup>1</sup>CIRIR-Center for International Research on Impacts and on Rochechouart- 2, Faubourg du Puy Moulin-87600 Rochechouart-France, lambertbdx@gmail.com, <sup>2</sup>carl.alwmark@geol.lu.se, <sup>3</sup>david.baratoux@get.obs-mip.fr, <sup>4</sup>brack@cnsr-orleans.fr, <sup>5</sup>p.bruneton@orange.fr, <sup>6</sup>Elmar.Buchner@hs-neu-ulm.de, <sup>7</sup>phil.chevremont@gmail.com, <sup>8</sup>phclaeys@vub.ac.be, <sup>9</sup>mrdence@rogers.com, <sup>10</sup>jpfloch@gmail.com, <sup>11</sup>FRENCHB@si.edu, <sup>12</sup>gattacceca@cerege.fr, <sup>13</sup>roger.gibson@wits.ac.za, <sup>14</sup>Steven.Goderis@vub.ac.be, <sup>15</sup>rgrieve@nrcan.gc.ca, <sup>16</sup>kvhodges@asu.edu, <sup>17</sup>fhorz@aol.com, <sup>18</sup>F.Jourdan@exchange.curtin.edu.au, <sup>19</sup>simon.kelley@open.ac.uk, <sup>20</sup>thomas.kenkmann@geologie.uni-freiburg.de, <sup>21</sup>Kring@lpi.usra.edu, <sup>22</sup>falko.langenhorst@uni-jena.de, <sup>23</sup>Martin.Lee@glasgow.ac.uk, <sup>24</sup>Paula.Lindgren@glasgow.ac.uk, <sup>25</sup>johanna.lofi@gm.univ-montp2.fr, <sup>26</sup>Jean-Pierre.Lorand@univ-nantes.fr, <sup>27</sup>luais@crpg.cnrs-nancy.fr, <sup>28</sup>vcms@mail.ru, <sup>29</sup>alain.meunier@univ-poitiers.fr, <sup>30</sup>CMoore@asu.edu, <sup>31</sup>ormoj@cab.inta-csic.es, <sup>32</sup>gosinski@uwo.ca, <sup>33</sup>sabine.petit@univ-poitiers.fr, <sup>34</sup>pohl@geophysik.uni-muenchen.de, <sup>35</sup>quesnel@cerege.fr, <sup>36</sup>nelly@hubertreeves.info, <sup>37</sup>rochette@cerege.fr, <sup>38</sup>haley.sapers@gmail.com, <sup>39</sup>martin@suevite.com, <sup>40</sup>peter\_schultz@brown.edu, <sup>41</sup>susanne.schwenzer@open.ac.uk, <sup>42</sup>mrscomet3@aspect1.net, <sup>43</sup>dieter.stoeffler@mfn-berlin.de, <sup>44</sup>herve.trumel@wanadoo.fr, <sup>45</sup>frances.westall@cnsr-orleans.fr, <sup>46</sup>axel.wittmann@asu.edu, <sup>47</sup>kai.wuennemann@mfn-berlin.de

**Introduction:** Owing to its size, accessibility and erosional level, the Rochechouart impact structure [1], dated at  $\sim 203 \pm 2$  Ma (recalc.) [2], is a unique reservoir of knowledge within the population of the rare terrestrial analogous to large impacts craters observed on planetary surfaces [1-4]. The site gives direct access to fundamental mechanisms both in impact-related geology (origin and evolution of planets) and biology (habitability of planets, emergence and evolution of life). For the last decade P. Lambert has been installing Rochechouart as International Natural Laboratory for studying impact processes and collateral effects on planetary surfaces. For this purpose the Center for International Research on Impacts and on Rochechouart (CIRIR) was installed on site in 2016 with twofold objectives and activities. First ones are scientific and dedicated to the scientific community. The second are cultural and educational and are dedicated to the public *sensu lato*. We present here the CIRIR, its scientific programs and the related research opportunities.

**CIRIR Status:** CIRIR is a public initiative of the local territories in the form of an Association composed exclusively of public officials. It is entirely funded by public money. CIRIR is placed under the governance of a fully independent director reporting to the public authorities and covering both scientific and outreach activities.

**Scientific Objectives:** The CIRIR aims at developing research on Rochechouart impact crater and on impact related processes of planetary significance, such as for instance, the installation of an impact trig-

gered hydrothermal cell upon cooling after impact, or the readjustment, mechanism which are particularly accessible and effects well exposed at Rochechouart impact structure.

On the first ground CIRIR is planned as a resource facility for ground truth data mining. It is a base camp for further field studies and a unique dynamic data/sample library. It aims at collecting and curating materials and data within the impact structure *sensu lato*, far beyond the preserved breccia deposits marking the bottom of the initial crater, and far beyond the actual perimeter of the “Reserve Naturelle Nationale de l’Astroblème de Rochechouart-Chassenon”.

CIRIR also instigates and leads incentive measures such as the 2017 drilling campaign in/by the National Reserve (see next).

**Means and Programs:** CIRIR is composed of two buildings, one for the Rochechouart sample facility and the second for accommodating visiting scientists and students. Space and equipment will be provided for sample preparation and for petrologic observation.

For achieving its ambitious objectives, the CIRIR involves and coordinates both scientists and the public in a participative approach. This includes the set up and the management of a continuous and systematic sampling campaign (ground and drilling) of the greater Rochechouart structure (proximal and distal zones). Scientists, as well as landowners, local public authorities, and enterprises on site will participate in the CIRIR as providers of the “raw material”, counterbalancing a drawback for field geology at Rochechouart, i.e. heavy vegetation and relative paucity of outcrops.

The CIRIR includes a small headquarters with the director on-site and a large network of collaborators worldwide with 3 active teams plus a group of retired legendary peers of the discipline forming the “Comité des Sages” (see Table 1). All members of CIRIR are contractually linked and engaged in a common goal: the implementation of active research and/or outreach, related to materials and data collected in/on the territories involved by the Rochechouart impact at large. One team deals with the public relations, education, culture and related activities, a second with research, and the third one is transversal and provides support to the others. The two first teams (PI teams) are composed individuals and groups having vocation to set up and lead independent project(s). The PIs have the discretion to design and implement their project in full independence, but all projects comply with the group rules. They are placed under the supervision of the “Comité des Sages”, and CIRIR director coordinates the whole exercise. All projects are visible and will benefit all members. The CIRIR headquarters provides the materials and support (coordination, administration, sample management, field assistance, including lodging and facilities on site), but does not fund projects. It is up to each PI to raise support for their project(s). In case of overlap or risk of conflict between project(s), PIs involved have agreed to group and to share tasks under the coordination of one of them.

#### The 2017 Drilling Campaign at Rochechouart:

The first major initiative of CIRIR scientific programs is the organization and the management of the first scientific drilling campaign ever conducted at the Rochechouart impact structure. The program is endorsed and funded by the National Reserve [4]. Over 20 shallow drill holes targeting 350-400 m in cumulated length will be distributed over 8 sites spread along two 10 km radial traverses across the center of the structure [4]. Beyond specific issues such as initial crater size and morphology, age of impact, distal effects, characteristics of the target and of the projectile, major scientific objectives are similar to those of the 2016 drilling program at Chicxulub [5]. This includes crater formation mechanics, characterization of impact-induced alteration processes, and the evaluation of possible effects of large impacts on the habitability of planets and the emergence of life.

**Conclusions and Perspectives:** CIRIR and its programs are set, operational and launched. They result in immediate research opportunities with the promises of a better understanding of Rochechouart, of large impacts and of their collateral effects on Earth and on planetary surfaces. Those interested in joining and in contributing to our programs are welcome to contact us with their expressions of interest. Practical

details and projects will be further developed at the time of the conference.

**References:** [1] Kraut F. (1969) *Geologica Bavarica* 61: 428–450. [2] Schmieder M. et al. (2010) *MAPS* 45, 1225–1242. [3] Lambert P. (2010) *GSA Spec Pap.* 465, 505–541. [4] Lambert P. et al. (2016) *MAPS*, Abstract, #6471.pdf. [5] Morgan J. V. et al. (2016) *Science*, 354, 878–882.

CIRIR-COMITE DES SAGES			
BOARD OF SENIOR EXPERTS, ENDORSMENT & ETHIC			
Name	Affiliation (ex-affiliation)		Nation
Dence	Michael	Dominion Observatory-Service Géologique du Canada, Ottawa	Canada
Grieve	Richard	University of Western Ontario, London, Ontario	
Reeves	Hubert	CNRS/CEA-Paris-France	
Meunier	Alain	Université de Poitiers	France
Brack	André	CNRS-Orléans	Germany
Stöffler	Dieter	Natural History Museum-Humboldt-University, Berlin	
Pohl	Jean	Ludwig-Maximilians-University, Munich	
Masaitik	Victor	Karpinskii All-Russian Geological Research Institute, St. Petersburg	Russia
Snoemaker	Carolyn	US Geological Survey, Flagstaff, Arizona	USA
Hörz	Fred	Nasa, Johnson Space Center, Houston, Texas	
Schultz	Pete	Brown University, Providence, Rhode Island	
Moore	Carleton	Center for Meteorite Studies, Tempe, Arizona	
French	Bevan	Smithsonian Institution, Washington DC	

CIRIR-PI TEAM-RESEARCH			
Name	Affiliation		Nation
Gibson and group	Roger	University of the Witwatersrand, Johannesburg	South Africa
Jourdan and group	Fred	Curtin University, Perth	Australia
Claeys and group	Philippe	Vrije University, Brussels	Belgium
Goderis	Steven	Vrije University, Brussels	
Sapers	Haley	University of Western Ontario, London, Ontario	Canada
Osinski and group	Gordon	University of Western Ontario, London, Ontario	
Baratoux	David	Université de Toulouse	France
Gattacceca	Jérôme	Université Aix-Marseille	
Luais	Béatrice	CNRS-CRPG Université de Lorraine	
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Rochette and group	Pierre	Université Aix-Marseille	
Westall and group	Frances	CNRS-Université Orléans	Germany
Kenkmann and group	Thomas	University of Freiburg	
Langenhorst and group	Falko	University of Jena	
Wünnemann and group	Kai	Museum für Naturkunde-Humboldt Universität-Berlin	Spain
Ormó and group	Jens	Centro de Astrobiología Madrid	
Åhnmark	Carl	Lund University	Sweden
Kelley and group	Simon	Open University	UK
Lee and group	Martin	University of Glasgow	
Schwenzer	Susanne	Open University	
Hodges and group	Kip	Arizona State University, Tempe	USA
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Wittmann	Axel	Arizona State University, Tempe	

CIRIR-SUPPORT TEAM-RESEARCH			
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Chevremont	Philippe	Ex. BRGM-Service Géologique National	
Floc'h	Jean-Pierre	Ex. Université de Limoges	
Lambert	Philippe	CIRIR-Rochechouart/Sciences & Applications-Bordeaux	
Lofi	Johanna	Université de Montpellier	
Lorand	Jean Pierre	Université de Nantes	
Petit et IC2MP	Sabine	Institut Chimie des Milieux et Matériaux de Poitiers (IC2MP)	
Ramboz	Claire	CNRS-Institut des sciences de la terre d'Orléans	
Truini	Hervé	CEA-Le Ripault-Monts	Germany
Buchner	Elmar	University of Applied Sciences Neu-Ulm	

Table 1: CIRIR Scientific teams

TASKS	OPERATOR	2017	2018	2019
Scientific programme setting	P. Lambert (on behalf of the Reserve and public authorities)	COMPLETED		
Funding	Reserve (Funding sources : Local authorities, French State, EU)	COMPLETED		
Autorisations, selecting drilling Cie, contracts...	Reserve			
Final validation	Scientific Committee of the Reserve			
Realization of the drillings	Selected drilling Cie			
Call for PI's and organizing scientific valorization	CIRIR			
Set up of the research projects	Individual PI's (with CIRIR support for logistics and coordination)			
Initial examination of cores	CIRIR Support Task Force and PI's			
Sample preparation (halving, indexing)	CIRIR (on behalf of the Reserve)			
Sample Authorizations and procedures	Reserve with CIRIR assistance			
Sample distribution	CIRIR (on behalf of the Reserve)			
Studies	CIRIR PI's			
Public valorization	CIRIR and Reserve			

Table 2 : Drilling Programme: Timetable