CIRIR PROGRAMS: DRILLING & RESEARCH OPPORTUNITIES AT THE ROCHECHOUART IMPACT STRUCTURE

P. Lambert[1] , Alwmark C.[2], Baratoux D.[3], Brack A.[4], Bruneton P.[5], Buchner E.[6], Chevremont P.[7], Claeys P.[8], Dence M.R.[9], Floch J.P.[10], French B.M.[11], Gattacceca J.[12], Gibson R.L.[13], Goderis S.[14], Grieve R.A.F.[15], Hodges K.V.[16], Hörz F.[17], Jourdan F.[18], Kelley S.P.[19], Kenkmann T.[20], Kring D.A.[21], Langenhorst F.[22], Lee M.R.[23], Lindgren P.[24], Lofi J.[25], Lorand J.P.[26], Luais B.[27], Masaitis V.[28], Meunier A.[29], Moore C.B.[30], Ormö J.[31], Osinski G.R.[32], Petit S.[33], Pohl J.[34], Quesnel Y.[35], Reeves H.[36], Rochette P.[37], Sapers H.M.[38], Schmieder M.[39], Schultz P.H.[40], Schwenzer S.P.[41], Shoemaker C.S.[42], Stöffler D.[43], Trumel H.[44], Westall F.[45], Wittmann A.[46], and Wünnemann K.[47].

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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	France
Brack	André	CNRS-Orléans	
Meunier	Alain	Université de Poitiers	
Pohl	Jean	Ludwig-Maximilians-University, Munich	Germany
Stöffler	Dieter	Natural History Museum-Humboldt-University, Berlin	
Masaitis	Victor	Karpinskii All-Russian Geological Research Institute, St. Petersburg	Russia
French	Bevan	Smithsonian Institution, Wahsington DC	USA
Hörz	Fred	Nasa, Johnson Space Center, Houston, Texas	
Moore	Carleton	Center for Meteorite Studies, Tempe, Arizona	
Schultz	Pete	Brown University, Providence, Rhode Island	
Shoemaker	Carolyn	US Geological Survey, Flagstaff, Arizona	

Owing to its size, accessibility and erosional level, the Rochechouart impact structure [1], dated at ~203 ± 2 Ma (recalc.) [2], occupies a critical position within the population of rare terrestrial analogs to the large impacts craters observed on planetary surfaces [1-4]. The site allows direct access to researchers investigating fundamental mechanisms both in impact-related geology (origin and evolution of planets) and biology (habitability of planets, emergence and evolution of life).

CIRIR: A RESOURCE & A PROGRAM CENTER
for VALORIZING IMPACT STUDIES and ROCHECHOUART

Public organization at the initiative of Rochechouart territories, funded by public money and placed under the governance of a fully independent Director reporting to the public authorities

FACILITIES & MEANS

HEADQUARTER
Director + smalll team on site

Impact on shelve
OPERATIONAL LATE 2017

Hosting and curating cores and surface samples

Preparing, Observing, Selecting Samples

OPERATIONAL EARLY 2018

Hosting scientists & students, providing them support & equiment for field & petrologic studies, sampling and training…

OPERATIONAL 2018

Permanent systematic sampling

Surface programs *Involving both the scientists & the public*

Drilling programs

Building 2
Studies & Housing Facility

Base camp for ground truth data mining impact and collateral effects (support and expertise for field work and sampling)

also for sampling "indoor" (sample facility)

Large off site teams

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

Personalities & groups having vocation to set up and lead independent project(s) coordinated by the CIRIR

CIRIR-SUPPORT TEAM-RESEARCH			
Name		Affiliation	Nation
Lindgren	Paula	University of Glasgow	UK
Bruneton	Patrice	Ex. AREVA	France
Chevremont	Philippe	Ex. BRGM-Service Géologique National	
Floc'h	Jean-Pierre	Ex. Université de Limoges	
Gattacceca	Jérôme	CNRS Aix-Marseille	
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	
Rochette & group	Pierre	Université Aix-Marseille	
Trumel	Hervé	CEA-Le Ripault-Monts	
Buchner	Elmar	University of Applied Sciences Neu-Ulm	Germany

Personalities & groups having no vocation to set up and lead independent project(s) , but which are willing to contribute to the CIRIR programs by bringing their experience and expertise in support to the CIRIR and members

Outside the scope of the presentation here
Education
Culture, Social, Economics…

Public objectives

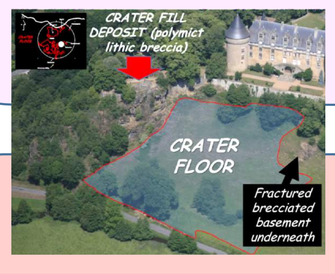
PROGRAMS

All members are contractually linked & engaged in a common goal: the implementation of active research and/or outreach, related to materials and data collected in/on the territories affected by the impact.

Scientific objectives

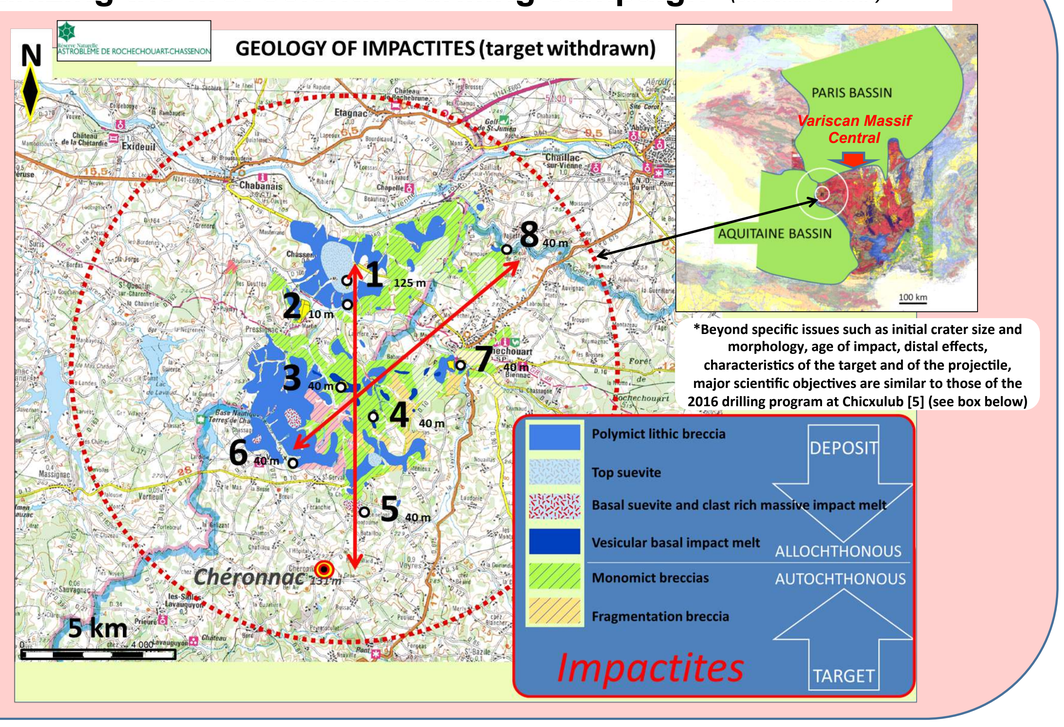
ROCHECHOUART, INTERNATIONAL NATURAL LABORATORY

Incentives for Impact studies



SITES	Drilling	
	Hole n°	Depth (m)
n°1: Chassenon	1	125
	2-3	1 each
n°2 : Champonger	4	10
	5-6	3-1
n°3: Valette	7	40
	8-11	1 each
n°4: Recoudert	12	40
	13-14	1 each
n°5 : Montoume	15	40
	16-19	1 each
n°6: Puy Chiraud (Videix)	20	40
	21-23	1 each
n°7: Rochechouart castle	24	40
	25-26	1-3
n°8: Champagnac quarry	27	40

CIRIR SCIENTIFIC PROGRAMS:
Organizing the first scientific drilling campaign* *(on behalf of NNR)*



*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] (see box below)

CIRIR SCIENTIFIC PROGRAMS-TIME TABLE				
TASKS	OPERATOR	2017	2018	2019
Field studies support & Surface sampling	CIRIR studies & housing facility CIRIR sample facility			
1rst drilling campaign-Legal aspects, contracts…	NNR ("Réserve Naturelle Nationale de l'Astroblème Rochechouart-Chassenon")			
1rst drilling campaign-Financial aspects, fundiing	P. Lambert (on behalf of NNR and public authorities)	COMPLETED		
1rst drilling campaign-Scientific aspects, drill plans	NNR (Funding sources : Local authorities, French State, EU)	COMPLETED		
Final validation	Scientific Committee of NNR			
Realization of the drillings	Selected drilling Cie			
1rst Call for PI's and organizing scientific valorization	CIRIR			
Research projects set up and launch-"1rst round"	Individual PI's (with CIRIR support for logistics and coordination)			
Initial examination of cores	CIRIR- Support team and PI's			
Student training opportunities	CIRIR- Support team and PI's			
On site field & work sessions	CIRIR and all teams			
Sample preparation (halving, indexing, …)	CIRIR (on behalf of NNR)			
Sample loan & Authorizations	NNR with CIRIR assistance			
Sample distribution	CIRIR (on behalf of NNR)			
Studies	CIRIR PI's			
2nd call for PI's and organizing scientific valorization	CIRIR			
Research projects set up and launch-"2nd round"	Individual PI's (with CIRIR support for logistics and coordination)			
2nd drilling campaign: feasibility, deep drilling plans ?	CIRIR and all teams			
Restitution - Science	LPSC, Met Soc, other meetings			
Restitution - Public	CIRIR, all teams and NNR			

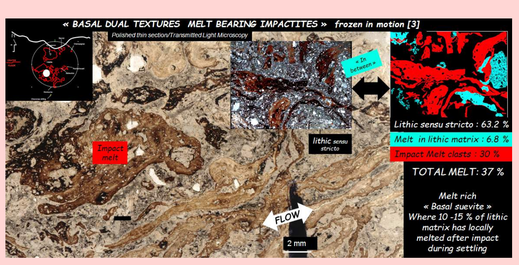
LPSC-48th

CIRIR SCIENTIFIC PROGRAMS
Facilitating and coordinating international research on Rochechouart materials

CIRIR PIs PROJECTS already COMPLETED

1-(U-Th)/He, U/Pb, and Radiation Damage Dating of the Rochechouart Impact Structure, France
Ms-Sci.Thesis A. Horne, 2016-Arizona State University

2-Geochemical and mineralogical studies of meteorite impact-generated hydrothermal systems on Earth and tracing sources of water: observations from the Rochechouart impact structure
Ms-Sci. Thesis S. L. Simpson, 2015-University of Glasgow



Color code caption :	
Main disciplin	Relevance
Petrology	1- Impacts in general
Geochemistry	2Specific to Rochechouart
Geophysics	

Actual call: CIRIR PIs INTENDED PROJECTS
As of March 2017

The PIs have the discretion to design and implement their projects in full independence, but all projects comply with the group rules. They are placed under the supervision of the "Comité des Sages", and the CIRIR Director coordinates the whole exercise.
The CIRIR headquaters 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).

CRATERING MECHANICS

Crater deposits emplacement[1,2]

7 PROJECTS *Quantification of indicative shock metamorphic features in impact deposits for constraining emplacement, Formation and emplacement of impact melt-bearing impactites , Suevite formation, Classification, Incidence of target environment and of proximity to seawater on crater deposits , Nature, origin and significance of "impactoclastites", Bottom melt bearing rocks, texture, origin and emplacement,*

2 PROJECTS *3D-Geometry of deposits, Emplacement & post emplacemet processes*

Modification stage issues[1,2]

3 PROJECTS *Impact dikes, fractures, pseudotachylitic breccias, distribution, nature, origin*

Projectile fate[1,2]

2 PROJECTS *Geochemical and isotopic incidence of impact process on projectile materials*

CRATER SIZE-SHAPE[1,2]

2 PROJECTS *3D-shock barometry in the target for constraining size & mophology, Search for a central peak or peak ring using metamorphic grades of basement rocks as tracers*

HYDROTHERMAL CELL[1,2]

2 PROJECTS *Hydrothermal phases & implications, deconvolving super-imposed alteration events*

4 PROJECTS *Cooling time & rate, modeling & refining models*

PROJECTILE[1,2]

1 PROJECT *Exotic phases on shatter cones*

2 PROJECTS *Identification issues, Distribution of projectile in and around the crater*

LIFE-HYDROTHERMALISM[1,2]

1 PROJECT *Characterisation of post-impact biological colonisation in the Rochechouart hydrothermal system*

2 PROJECTS *Concentrations of elements acting as nutrients in the hydrothermal fluid, Refining models*

AGE[2]

1 PROJECT *Precise U/Pb dating impact-related zircons with TIMS*

4 indirect projects *(radiometry for constraining cooling rates)*

METHODOLOGY[1]

Impact structure reconnaissance

1 PROJECT *Evaporation condensation as marker of impact process*

1 PROJECT *Portable K, Th and U for impact reconnaissance and mapping*

Barometry Thermometry

1 PROJECT *U/Pb and noble gas isotopic signatures for tracing shock and temperature below impact crater*

Reprocessing and incidences

1 PROJECT *How different chronometers behave during alteration and aging*

1 PROJECT *Redistribution of K, Th and U in relation with shock and post impact alteration*

Phase carriers and incidence

2 PROJECTS *Linking post-impact mineralogy with Ar-Ar and/or U/Pb results, How different chronometers respond to the impact in different impact rock components*

Research Opportunities: CIRIR Programs are open. 1rst call for projects closes Sep. 2017, 2nd call opens Jan. 2018
Those interested in joining & in contributing are welcome. Contact us with expressions of interest

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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.