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THE SAINTE-ROSE MOON-MARS ANALOGUE VOLCANIC SITE AT LA REUNION FOR PREPARING FUTURE GEOLOGICAL AND HUMAN EXPLORATION

Author : Pignolet Guy
Science Advisor, SALM Sainte-Rose, La Réunion, France, Europe
guy.pignolet@science-sainte-rose.net

Co-Authors : Fontaine Laurent[*], Chabriat Jean-Pierre[t]

ABSTRACT

The international space community is preparing returns to the Moon with robots and with men, and beyond, the robotic and human exploration of Mars. In preparation for these new developments, it is useful to do experimental work in analogue sites presenting similarities with Lunar and Martian conditions, for the purpose of testing equipments and procedures both in terms of technology and from the organisational point of view. One of the favourite sites is the Piton de la Fournaise Volcano, mostly located on the territory of the city of Sainte-Rose in Reunion Island, a French region of the European Union. With its diverse volcanic mineral landscape zones, La Fournaise is one of the places on Earth that features best the large volcanoes on planet Mars and the volcanic structures found on the Moon. Furthermore, Reunion Island offers an excellent environment in terms of logistics and professional support, with infrastructures featuring full European standards, and daily direct flights with Paris, France. Time lag with continental Europe is very small, and there is a minimum of administrative and security burdens for access, especially for European researchers. The University of La Reunion and research or technology institutes on the island feature future-oriented quality laboratories, in the fields of vulcanology, biology, electronics, information, and energy. The city of Sainte-Rose has great ambitions in terms of energies for the future, with photovoltaic farms and OTEC projects. Sainte-Rose also already has experience with space activities. The city of Sainte-Rose will readilly offer a permanent facility for administrative and technical support when researcher's teams come for experimenting space exploration equipment and concepts for the exploration of the Moon and Mars at the analogue site of La Fournaise Volcano. The implementation of the lunar/martian analog research site in Reunion Island will bring many positive returns in terms of technology know-how, knowledge and science, prestige and economy, for the city of Sainte-Rose, for Reunion Island, and for the Lunar / Mars research communities, including in new developments for the future exploration of lava tubes that have been discovered on the Moon and on Mars.

I. MOON MARS ANALOGUE SITES

One of the most interesting Analogue Sites for Moon and Mars volcanic structures may be found on Earth on the territory of Sainte-Rose in Reunion Island, on one of the "hot points" of our planet. Reunion Island is a French Region of the European Union.

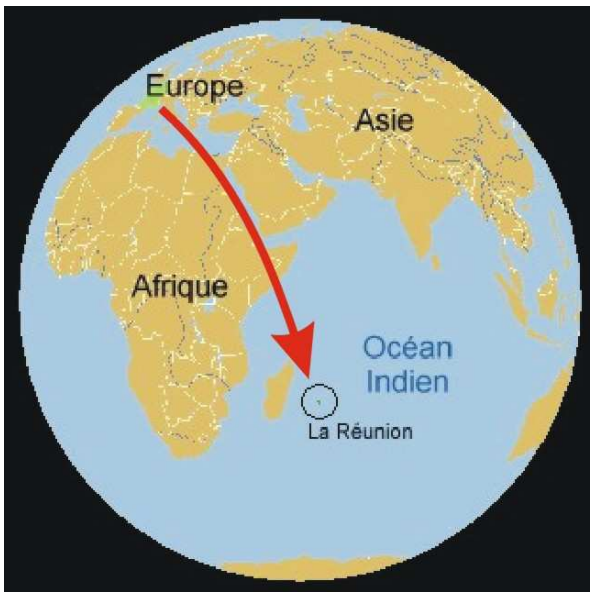

Fig. I. Moon-Mars Analogue Site in European Union

[*]Fontaine Laurent, Administration Officer,
SALM Sainte-Rose, La Réunion, France, Europe
laurent.fontaine14@wanadoo.fr
[t]Chabriat Jean-Pierre, Dean, UFR Sciences & Technology, U. of La Réunion, France, Europe
doyensc@univ-reunion.fr

The international space community is preparing returns to the Moon with robots and with men, and beyond, the robotic and human exploration of Planet Mars. In preparation for these new developments, it is useful to do experimental work in analogue sites presenting similarities with Lunar and Martian conditions, for the purpose of testing equipments and procedures both in terms of technology and from the organisational point of view. Analogue sites are half way between lab testing and real planetary exploration. One favourite "Site Analogue Lune Mars" (SALM) for doing such testing is the Piton de la Fournaise Volcano, located for its most part on the territory of the small city of Sainte-Rose.

II. SALM SAINTE-ROSE IN REUNION

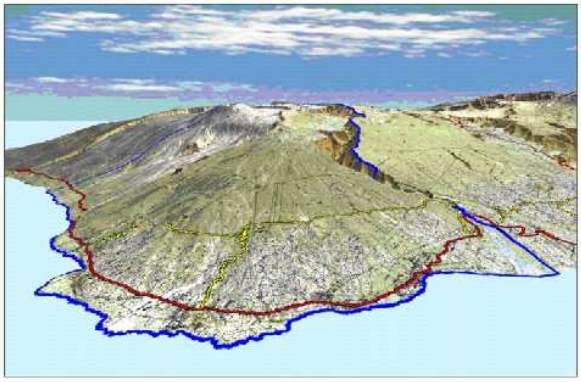

Fig II. Piton de La Fournaise Volcano, with caldeiras, and the territory of Sainte-Rose in Reunion Island.

Sainte-Rose and La Fournaise offer a diversity of volcanic mineral environments and structures, from sandy plains made by ashes and projections to a diversity of lava flows that occasionnaly still come alive. Not waiting for the planetary experimenters, many visitors of La Fournaise Volcano have claimed the feeling to have landed on the Moon or on Mars. All this is part of an extraordinary diversity and beauty that had La Reunion recently recognised as World Heritage by Unesco, for its unique landscapes.

European researchers and the world community of planetary explorers have eventually become aware of the potential offered in Sainte-Rose for preparing the future robotic and manned exploration of the Moon and Planet Mars, and a cooperation agreement was offically signed in June 2010 at the GLUC Global Lunar Conference in Beijing, between the ILEWG (International Lunar Exploration Working Group) Executive Director Dr. Bernard Foing, and the municipality of Sainte-Rose represented by its Mayor M. Bruno Mamindy Pajany.

III. SMALL CITY WITH SPACE EXPERIENCE

Fig.III. Partly engulfed by lava in 1977, a former local Police Station will host the permanent base for SALM logisitics and educational activities.

Being involved with space activities is not a new experience for the community of Sainte-Rose. It already acted as a sponsor of the Sputnik-40-Years high-school satellite, and as a host of the IAF Education Committee seminar in 1997. In 2006 NASA had installed in Sainte-Rose a tracking station for the launch of the New Horizons probe to Pluto. Also in 2006 a symbolic lychee fruit was prepared in Sainte-Rose for spaceflight and it was launched on board of Bigelows' Genesis-2 spacecraft. It is still orbiting in the nights over Sainte-Rose and the World.

Part of a city building has been committed for SALM operations, featuring an office, a meeting room and a hall to be used for display or for staging. Il will be used to support experimenters of ILEWG and space groups during technical campaigns, and it will host public outreach activities for the rest of the time.

IV. A HUGE SHIELD VOLCANO

Fig.IV. The summit caldeira of La Fournaise Volcano

La Reunion, located on one of the magmatic “hot spots” of Planet Earth, is a large shield-type volcano, rising 7 km high above the floor of the ocean, with a span of about 200 km across at its base. It is possibly the volcanic structure that on Earth ressembles most the large volcanoes found on the surface of Mars, with a whole diversity of geological features.

Because La Fournaise is a frequently active volcano, with periods of erupting and quiet ones, it also offers interesting possibilities to observe the development of new life on mineral environments after an eruption.

V. EXPLORATION OF LAVA TUBES

Fig. V. Opening of a lava tube under a lava flow

Lava tubes are a very important and interesting feature of the construction of a volcanic landscape. They have been found on the Moon, and automatic exploration of lava tubes is a technical challenge.

Fig. VI. Inside a lava tube near an opening

How will equipement deal with pits, with boulder chaos. How to track the equipement under the ground, and how to communicate data with the robots ? Would lava tubes offer dwelling and protection to human explorers, as has already been suggested ? New concepts need be developed and tested in analogues .

Fig. VII Inside a large cave in a lava tube in Reunion, (this one featuring a skylight opening in the dome)

VI. ACADEMIC SUPPORT

The UFR Faculty of Science and Technology at the University of La Reunion has full capability to offer academic and laboratory support to experimenter teams visiting SALM Sainte-Rose, and may at some point develop research of its own.

VII. ACKNOWLEDGEMENTS

We would like to thank especially M. Philippe Huet, an Education Officer with the Volcano Regional Museum, and Mrs. Lucette Ferlicot, a science teacher and a specialist of volcanic morphology. We owe special thanks to M. François Martel-Asselin for his valuable contributions about exploring lava tubes.

VIII. CONTACTS

A web site is developing to follow-up on the activities of SALM Sainte-Rose at the address :

http://www.science-sainte-rose.net/salm

All questions may be addressed by email to :

<salm@science-sainte-rose.net>