



NASA ASTROBIOLOGY INSTITUTE ANNUAL REPORT YEAR 4

[July 2001 – June 2002]

Project Report: Delivery of Organic Materials to Planets

Director/Leader: François Raulin

GDR CNRS 1877, or Groupement de Recherche en Exobiologie is a national federation of research laboratories in Exo/Astrobiology, created by the National Centre of Scientific Research (CNRS) in 1999. Its main goal is to promote, induce and coordinate the development of Exo/astrobiology scientific programs in France. It includes about 50 laboratories and is supported by the CNRS and CNES (the French Space Agency).

4 main research topics are addressed:

- The ingredients of primitive life in their geological, planetological and interstellar context
- From the chemistry of the origins of life to the emergence of life: structures and functions of biological molecules
- Terrestrial life as a reference: fossils, biomarkers, extreme environments
- Habitats and signatures of extraterrestrial life?

GDR Exobio has a scientific Council with 16 scientists from different fields, including astrophysics and planetology, physics and chemistry, earth sciences, life sciences and also philosophy and epistemology. The GDR has been affiliated with the NAI since November 2001.

Main recent activities

During the period from November 2001 to June 2002, the GDR Exobio, within the framework of its main 4 topics, has been active in several directions directly connected to NAI activities. Below are just a few examples of these activities, with corresponding references given in the Reference list.

The development of instrumentation for in situ exobiologically oriented analyses of Martian soil has been reported by GDR & US teams (Cabane et al, 2001).

Several important results on the properties of organic aerosols of Titan have been obtained by joint studies involving GDR and other teams (McKay et al, 2001; Ramirez et al, 2002)

Evidence of amino-acids formation from irradiation of interstellar ices analogues has been obtained by a joint study involving GDR and teams (Munoz Caro et al, 2002).

Detailed chemical analysis of micrometeorites gives evidence for the presence of organic carbon, with strong implication for extraterrestrial delivery of organics on the early Earth (Matrajt et al, 2001).

The search for indications of biological activity on extrasolar planets is also an important part of the studies carried out by the GDR team, involving large-scale cooperation, especially with other teams linked to the NAI (DesMarais et al, 2001; 2002).

A national Thematic School of Exobiology was organized by members of the GDR in La Colle-Sur-Loup, south of France, from September 20 to 30, 2001. The school was attended by 80 “students”, mainly researchers and PhD students, and was mainly concentrated on the chemical (prebiotic chemistry of the origin of life) and biological (Last Universal Common Ancestor, life in extreme environments as models of extraterrestrial primitive life) aspects (Meli et al, J. Biol. Chem, 2002).

A National colloquium of exobiology was organized by the GDR Exobio in Paris on May 27–29, and was attended by 130 scientists from all over the country. It allowed the French community to define the perspectives in Exo/astrobiology in the coming 4 years, as well as the future of GDR Exobio.

References

Cabane M., Coll P., Israël G., Raulin F., Sternberg R., Jambon A., Rodier C., Rannou P., Niemann H. and Mahaffy P. (2001). In Situ inorganic and organic analysis (Pyr/CD–GC/MS) of the martian soil, on Mars 2005 mission, *Planet. Space Sci.*, 49, 523–531.

DesMarais D., Harwitt M., Jucks K., Kasting J., Lin D., Lunine J., Seager, S., Schneider J., Traub W., et Woolf N., (2001). Biosignatures and Planetary Properties to be Investigated by the TPF Mission, *JPL Publication* 01–008.

DesMarais D., Harwitt M., Jucks K., Kasting J., Lin D., Lunine J., Seager, S., Schneider J., Traub W., et Woolf N., (2002). Remote Sensing of Planetary Properties and Biosignatures, *Astrobiology*, accepted

Matrajt G., Flynn G. J., Bradley J. P. and M. M. (2001) FTIR and STXM detection of organic carbon in scoriaceous-type antarctic micrometeorites. *Lunar Planet. Sci. XXXII*, #1336 (CD-ROM).

Mckay, C.P., A. Coustenis, M. Lemmon, R. Lorenz, R. Samuelson, M. Cabane, P. Rannou, P. Drossart (2001). The physical properties of the organic aerosols and clouds on Titan, *Planetary & Space Science*, 49, 79–99.

Meli, M., Vergne, J., Décout, J.L., and Maurel, M.C. (2002) Adenine–Aptamer Complexes. *J. Biol. Chem.*, 277, 3, 2104 –2111.

Munoz Caro G.M., Meierhenrich U.J., Schutte W.A., Barbier B., Arcones Segovia A., Rosenbauer H., Thiemann W.H.–P., Brack A., et Greenberg J.M. (2002), Amino acids from ultraviolet irradiation of interstellar ice analogues,

Nature, 416, 403–406.

Ramirez S.I., Coll P., Da Silva A., Navarro–Gonzalez R., Lafait J. and Raulin F. (2002). Complex Refractive Index of Titan's Aerosol Analogues in the 200–900 nm domain, *Icarus*, 156(2), 515–530, 2002.

Future Hopes

The GDR wishes to participate in cooperative programs of research on an international scale, on clearly identified topics, in the framework of its affiliation with the NAI. The NAI connection should be a great opportunity to share and exchange researchers, in particular PhD students, to promote joint participation in research programs on Exo/astrobiology, and to use the synergy induced by the different ways of thinking and working of researchers from different origins to promote the wide field of Exo/astrobiology. Targets such as Titan, in relation to Cassini–Huygens, Mars and its international program of exploration, Europa and extrasolar planets are already among the topics of high interest likely to be part of such joint research projects.

In addition, the need for networking, with new and efficient tools for teleconferencing (including asynchronous communication) is part of the identified technical priorities.