THE HABITABILITY OF THE ICY SUBSURFACE AND THE POTENTIAL AQUEOUS OCEAN OF EUROPA. EXPERIMENTS AT HIGH PRESSURE. O. Prieto-Ballesteros[1] , F. Gómez[1], J.A. Rodriguez-Manfredi[1], V. García Baonza[2], A. Segura[3] and MALTA team, [1]Centro de Astrobiología, INTA-CSIC. Ctra. Ajalvir km.4, 28850 Torrejón de Ardoz. Madrid. Spain (prietobo@inta.es), [2]Facultad de CC. Químicas. Universidad Complutense de Madrid, Spain, [3]Universidad de Valencia, Spain.

Introduction: The jovian satellite Europa is a prioritary object to be explored for the space agencies because the discovery of indirect evidences of a possible aqueous ocean in its interior. It is assumed that the presence of liquid water is one of the requisites neccesaries to consider a planetary environment as habitable. There are some other fundamental requirements such as favourable conditions for the development of complex organic molecules and the existence of available energy sources for maintaining the metabolism of the organisms.

Plans for the future exploration of this satellite include the characterization from the Astrobiological point of view of the accesible environments. In this direction, the LAPLACE mission (a candidate mission to explore the Jupiter system proposed to ESA 2015-2025 Cosmic Vision plan) consider the characterization of Europa as an habitable object among their objectives: the mission will try to confirm the presence and the depth of liquid water reservoirs, and to characterize the surface and the near subsurface environments.

The potential habitable environment in the interior of Europa is characterized by a very extreme conditions. Parameters that restrict the habitability are, as well as liquid water, radiation, pressure, temperature, acidity, salinity, nutrients and time [1]. Microorganisms adapted to the deep interior habitats of Europa should be, at least, baro-tolerant and non-fotosynthetic.

A set of experiments using different simulation chambers have been planned in order to study a) the survival of microorganisms in conditions of Europa and b) the preservation of some biosignatures to the surface conditions, which could have originated under pressure.

We will present preliminary results of some experiments made with different microorganisms increasing the pressure. This research is included as one of the objectives of the multidisciplinary MALTA-Consolider project. This project groups the main spanish teams which usually work in high pressure research. One of the most fundamental goals in MALTA-Consolider project is to mimic processes and phenomena similar to those occurring in the interior of the Earth and other planetary objects (phase transitions, chemical reactions, microbiological activity, to name a few) and to understand their physical, chemical, geological, and biological foundations and implications.

The High Pressure Planetary Simulation Chamber (HPPSC): A new equipment for the simulation of different planetary environments at high pressure has been built at Centro de Astrobiolgia in Madrid (Spain). The equipment has two different chambers, one for physico-chemical studies which can reachs pressures up to 10000 bar (called MINchamber), and other for biological experiments which has higher volume and can reachs up to 3000 bar (BIOchamber). Both can work in the temperature interval from 123 to 600 K. The heating/cooling system is an integrated circuit of liquid nitrogen and electric resistences.

Each chamber has four different ports to incorporate several sensors. They are used for making in situ analysis and to be able to monotorize the processes ocurring during the changes of pressure and tempearture. Currently, a raman spectrometer, and a video camera are installed on two ports using saphire windows. Other sensors able to be incorporated for specific studies are those to measure magnetic susceptibility , electrical resistivity, and mass spectrometry.

The whole system can be controlled automatically, being the pressure, the temperature and the rest of parameters registered while the experiment is running.

Figure 1. The HPPSC equipment.

Begining the simulation experiments: We have started to make a set of experiments to study the endurance and survival of some microorganism (*Deinococcus gen., Geobacter gen., and Escherichia gen.*) increasing pressure at intervals up to 3000 bars. Some

parameters such as the composition of the aqueous solution are varied in order to delimited each effect.

The microorganisms are dyed using a fluorofore as *BacLight Bacterial stain* in order to be able to control when they die in real time. Some analytical techniques will be used for organic matter preservation analysis.

Acknogledgements: We would like to thank to CRYOVAC S.L., the LAPLACE mission Team and the MALTA-Consolider Team.

References: [1] G. Marion et al. (2003) Astrobiology 3-4, 785-811