UV-RESISTANT YEASTS ISOLATED FROM SAIRECABUR VOLCANO, ATACAMA DESERT. A. A. Pulschen[1], F. Rodrigues[1], R. T. D. Duarte[2], I. F. Santiago[3], G. G. Araujo[4] and D. Galante[4], [1]Institute of Chemistry, University of Sao Paulo (Av. Prof. Lineu Prestes, 748, Butantã, CEP 05508-000, São Paulo, SP, Brazil, andrepulschen@usp.br [2]Instituto Oceanográfico, Universidade de Sao Paulo, Brazil. [3] Instituto de Ciencias Biológicas, Universidade Federal de Minas Gerais, Brazil. [4]Brazilian Sincrotron Light Laboratory, Centro Nacional de Pesquisa em Energia e Materiais.

Introduction: The Sairecabur volcano (5971 m), at the Atacama Desert, is a high-altitude extreme environment with high daily temperature variations, acidic soils, intense UV radiation and low availability of water. Four different species of yeasts were isolated from this region using oligotrophic media, identified and characterized for their tolerance to extreme conditions. All isolates showed high resistance to UV-C, UV-B and environmental-UV radiation. The presence of pigments, analyzed by Raman spectroscopy, correlated with UV resistance in some cases, but there is evidence that, on the natural environment, other molecular mechanisms may be as important as pigmentation, which has implications for the search of spectroscopic biosignatures on planetary surfaces and astrobiology studies.

Results and discussion: The yeasts isolates were identified by sequencing NL and ITS region. Altought more isolates from the same species were obtained, experiments were performed with one isolate from each species (*H.watticus*, *C.friedmannii*, *R.toruloides*, *Exophiala* sp.). We then used Raman spectroscopy to characterize the pigmentation of the yeasts (Fig. 1).

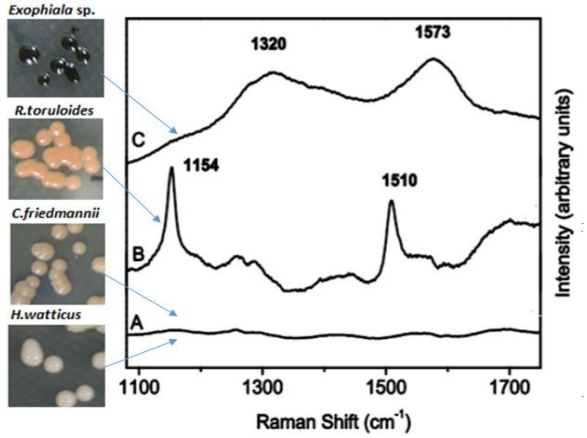

Fig. 1. Yeasts' colonies aspect and Raman spectra of the four yeasts isolated on the present work.

Raman spectroscopy is proposed in the literature as a technique for the search of biosignatures in the context of astrobiology [1]. The two strong peaks at *ca*. 1150 and 1510 cm^{-1} (Fig 1B) are well described on the literature as characteristic modes of carotenoids. Since carotenoids are widespread in different living systems and their Raman bands are intense, they are proposed as one potential spectroscopic biosignature for the detection of extant life on Mars [2]. The two broad bands at *ca*. 1320 and 1570 cm^{-1} (Fig. 1C) can be attributed to the class of melanin.

Altought only two yeasts presented Raman signals of pigments, we observed that even the non-pigmented yeasts have scored great UV-C resistance (Fig. 2)

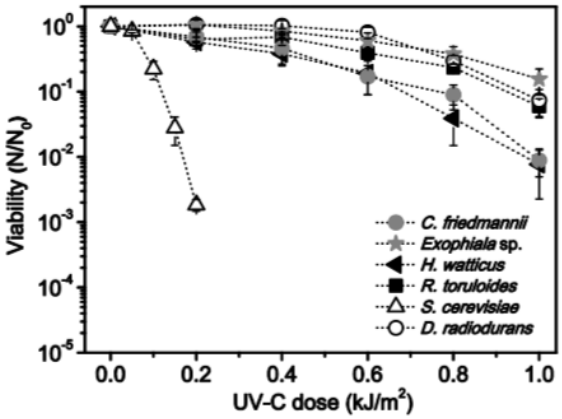

Fig. 2. UV-C resistance profile of the isolates. The radiotolerant bacteria *Deinococcus radiodurans* was used as a positive control of the experiment. The yeast *Sacharomycess cerevisiae* was used as a negative control.

In our additional experiments (not shown here), we manage to observe that the isolates were also resistant to UV-B and environmental-UV radiation. Since pigmentation itself does not completely block the effects of UV, other molecular mechanisms important for survival must be present, as, for example, photorepair.

Conclusions: All the yeasts isolated presents great UV resistance. However, its not possible to observe any evident pigment signal of some of the isolates when using Raman spectroscopy. The two "non-pigmented" yeasts also displayed some others astrobiologically interesting characteristiscs, as for example being able to growth at -6.5ºC. The existence of such extremophilic organisms without evident Raman spectra has implications for the search of spectroscopic biosignatures on planetary surfaces.

References:

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[2] Parnell, J., Cullen, D., Sims, M.R., Bowden, S., Cockell, C.S., Court, R. et al. (2007) *Astrobiology* **7**: 578-604.