

The 2016 International Summer School in Astrobiology: Final Report

From June 20—24, 2016, students from around the world gathered in Santander, Spain for the annual international summer school on astrobiology. The theme of this year's school, *Earth Analog Environments and the Search for Life Beyond the Earth*, was chosen to engage students studying extreme environments, Earth science, and Solar System science. The directors of this year's school were Miguel Mas Hesse from the Centro de Astrobiología de Madrid, and Rory Barnes from the University of Washington. The lecturers were Ricardo Amils, Kathy Campbell, Gian-Gabriele Ori, and Britney Schmidt.

The four instructors presented two lectures each and provided some guidance to 4 teams of students on group projects. Prof. Campbell gave lectures titled "Hot springs and other astrobiology-relevant sites on Earth" and "Cold seep environments as analog sites for astrobiology." Prof. Schmidt's lectures were "Europa, Enceladus and other icy worlds" and "Glacial Earth environments as Europa/Enceladus analog sites". Prof. Amils' lectures were "Río Tinto as a terrestrial Mars analogue" and "Importance of the dark biosphere for the habitability concept." Finally, Prof. Ori's lectures were "The geological history of Mars and its habitability: a multifold tale" and "From concepts to practice: Terrestrial Mars analogues for geology, astrobiology and human exploration." Attendance was taken at each lecture, and every student attended every lecture.

In addition to the formal lectures, the students were divided into 4 groups and instructed to design a mission to explore a Solar System environment with a complimentary terrestrial field site chosen to maximize the interpretations of the remote observations. Obviously a proper mission plan requires far more than a week, so the students were limited to using "realistic" technology that is or will be available in the next 25 years, and no budgetary constraints. The students met after classes and presented their proposals on the last day. All the instructors and directors agreed the students embraced this challenge enthusiastically and their presentations were outstanding.

On Wednesday, the students and instructors traveled by bus to the Basque town of Zumaia, home to the impressive Zumaia flysch. This region on the north coast of Spain displays thousands of layers of the rock record and is a stunning example of the tectonic forces of Earth. Among the strata is the iridium layer identified as the result of an asteroidal impact that caused the K-Pg mass extinction. The students and instructors explored the boundary layer by foot and by boat, led by Asier Hilario, the director of the geopark. This visit was arranged by a Spanish assistant director, Carlos Briones.

On Thursday night, Olga Prieto Ballesteros presented a public lecture "*Océanos planetarios, la nueva frontera de la exploración espacial*" that was attended by about 50 people. Some attendees were Spanish students of the school who probably appreciated a lecture in Spanish, even if it was at a more basic level.

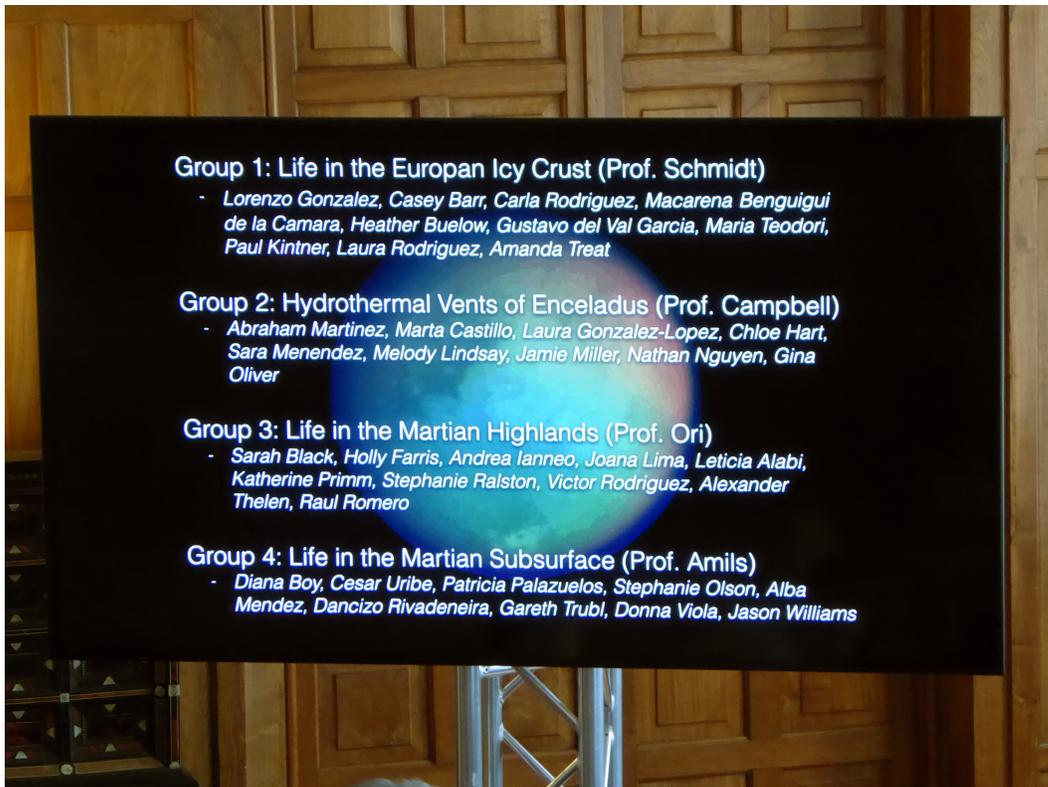
A total of 38 students attended this year's school, with 20 hailing from US institutions and the remainder from Europe. Of the students 13 were male and 25 were female. Ethnic information was not solicited. After the school, NAI students were asked to complete an anonymous survey of the school, and half the students responded (the results are appended to this report). Overall, the students were positive, with nearly all answers to all questions being "satisfied" or "very satisfied." In the open comments, several students suggested some form of ice breaker among students, and perhaps a banquet. I encourage both of these activities in the next school as this could put the students more at ease (and increase learning) and could greatly improve the likelihood that lifelong collaborations could be created from this school.

In summary, the 2016 summer school was a success with students from around the world engaging each other and the instructors to deepen their understanding of extreme environments on Earth and potential habitats beyond it. Notable areas for improvement are more time dedicated to student-student and student-instructor interactions. The Palacio de la Magdalena is a beautiful location that has sufficient amenities for the school. However, the food sucks.

Rory Barnes
Co-Director
Sept. 26, 2016



Prof. Britney Schmidt lectures at the 2016 International Summer School on Astrobiology.



Group projects.



Students working on their group projects in the Palacio de la Magdalena.



Asier Hilario, director of the Zumaia Geopark, explains the origin of the landscape.



Students touching the iridium layer.



Boat tour of Zumaia Flysch.



**XIV International School
of Astrobiology "Josep Comas i Solà"
Excursion to Zumaia Flysch. June 22, 2016**