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**Microbial Biodegradation of Plastics using Extremophiles
from Volcanic Environments**

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Plastics and microplastics are a major pollutant found in a vast array of environments worldwide. Certain species of bacteria and archaea have been revealed to degrade plastics at varying rates of efficiency. However, these microbes are not sufficient to battle the quantity of plastic waste produced. New microbial species and their subsequent enzymes are required to advance plastic research that will eventually benefit our planet. An overlooked classification of microbes in regard to plastic biodegradation, are extremophiles, described as microorganisms surviving in harsh environments. Thanks to the generous support of the Royal Society of Biology's Travel Grant, I was able to travel to Italy and collect samples from volcanic environments required for my MRes research project: Metagenomic Analysis and Plastic Biodegradation using Extremophiles from Volcanic Environments.

During the sampling trip, I visited several volcanic locations in Italy, the sites were selected considering the volcanic activity, a range of temperature, other environmental factors and of course safety and accessibility.

The first location was in Pomezia (Italy), where samples from three sites were collected: a temperate sulfuric solfatara pool (presumably the bubbles contained hydrogen sulfide which gave the characteristic rotten egg smell), a temperate bubbling pond and a temperate bubbling stream. At each site the temperature, pH and redox potential were recorded. In the solfatara (pH ~1.2 and ~20 °C), wet sediments and liquid samples were collected by attaching a falcon tube to a wire which was then tied to a pole and in a fishing line type manoeuvre, swung out into the pool to collect as much sample as possible. The sampling from the stream and from the bubbling pond was simpler and did not necessitate the pole; instead, falcon tubes were used to collect the water and sediments. Samples were processed on site or, if not possible, they were preserved at low temperature until further processing was performed back in the laboratory.

The second location I visited was a warm fumarole (~35 °C) in Naples. This site contained no water, so only the soil was collected using falcon tubes and stored for DNA analysis and microbial cultures back in the laboratory.

Finally, I visited a hot natural spring (pH ~6.5, ~60 °C), just outside of Viterbo. Interestingly, this site is used by locals as a swimming pool after it has cooled down, even though it contains arsenic. Water was collected in falcon tubes and most of it was filtered for DNA analysis, while unfiltered water and the biofilm were kept for setting up microbial cultures back at the laboratory.

Back at the University of Portsmouth, I have extracted DNA from 53 samples which will be sequenced, and microbial community composition determined. Then, selected samples will be sequenced for

metagenomic analysis to look for genes that encode for plastic degrading enzymes. In addition, some cultures have been set up with selected samples from each site, at different pH (from pH 1.5 to pH 6.5) and temperatures (from 30 °C to 70 °C) in order to obtain pure cultures of extremophiles. Eventually, these microbes will be placed in flasks containing plastics where plastic degradation and its efficiency will be assessed.

Upon completion of this project, I expect to find gene sequences known for encoding plastic degrading enzymes, which can be later used in Biotechnological applications if successful.

I am immensely grateful for the RSB Travel Grant for allowing me to carry out this field trip. My experience working on this project so far has been extremely invaluable and gratifying. I have gained an immense amount of knowledge and confidence in both the field and the lab, as well as having developed new skills which will be applied in my future career.



Samples collected during my time in Italy



Me taking water samples from the Solfatara in Pomezia



Me filtering water at the hot spring in Viterbo



Me taking the pH and temperature at the stream in Pomezia