

New constraints on the pre-eruptive storage conditions of the Campanian Ignimbrite (Campi Flegrei, IT)

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Solubility and phase equilibria experiments were performed on a synthetic trachyte representing the least evolved composition of the Campanian Ignimbrite (CI) eruption. H₂O and CO₂ solubilities were investigated at 1100°C and at pressure from 100 to 500 MPa for approx. 24h in an Internally Heated Pressure Vessel (IHPV). Phase equilibria experiments were performed at 100, 200 and 300 MPa and at temperature between 850°C and 1050°C in the Cold Seal Pressure Vessel (CSPV) and the IHPV under relatively oxidizing conditions (log fO₂=QFM+3.3 for IHPV; log fO₂=QFM+1 for CSPV). Run products were analysed by electron microprobe, spectroscopic techniques, Karl-Fischer titration and Carbon-Sulfur analyser.

For comparison natural samples from the juvenile parts of the CI were collected around the city of Naples and on the island of Procida. The collected products were analysed with the same techniques used for the experimental ones.

It was found that the solubility of water (X_{H₂O}=1) increases with pressure from 4.2 wt% at 100 MPa to 10.80 wt% at 500 MPa. The solubility of CO₂ (nominal X_{H₂O}=0) increases with pressure as well from 350 ppm at 100 MPa to 2700 ppm at 500 MPa. Comparing our experimental data with previous studies on the melt inclusions of the CI, a pressure between 100 and 200 MPa was evaluated for the melt prior to the CI eruption, indicating a magmatic storage region located between 2 and 6 km depth.

Comparing the paragenesis of the natural samples with those from the phase equilibria experiments, a temperature between 830°C and 880°C was estimated in the pressure range of 100-200 MPa for the magma prior to the CI eruption. Harker diagrams of experimental and natural samples were used to reconstruct the evolution of the CI melt. It is suggested that the crystal fractionation via differentiation plays a major role during the evolution of the magma prior to the CI eruption.

Variations in δD of fatty acids of Piezophilic Bacterium *Moritella japonica* DSK1 reflect biosynthetic pathways

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It is believed that bacterial metabolic pathways, not lipid biosynthesis, exert primary control on the variability of δD of lipids. In this study, we examined the δD of fatty acids in piezophilic bacterium *Moritella japonica* DSK1 that was grown in defined seawater medium with composite glucose as substrate at 30 megapascal. Fatty acids of DSK1 showed vastly varied δD, ranging from +44.4 to -171‰. Short-chain fatty acids (SCFA) had positive δD (average +3‰), whereas long-chain-polyunsaturated fatty acid (LC-PUFA) DHA (*cis*-4,7,10,13,16,19-docosahexaenoic acid) exhibited much depleted δD (-171‰). We show that the significant difference in δD between SCFA and LC-PUFA is a result of bacterial utilization of two distinct biosynthetic pathways that co-exist in the piezophilic bacterium. There was a wide range of hydrogen isotope fractionations between FA and growth water and between FA and substrate, but a nearly constant offset and a perfect correlation between the two fractionation factors, suggesting that the pools of hydrogens in the bacterium were metabolically linked and biosynthetically coordinated in biosynthesis of fatty acids. Thus, bacterial lipid biosynthetic pathways exert dominant, yet well-synchronized control on δD of fatty acids. Given the pressure-dependent carbon and hydrogen isotope fractionations observed in piezophilic bacterium *M. japonica* DSK1, we suggest that δD of fatty acids, together with their δ¹³C, can be used as a dual biogeochemical tracer to determine the source, diagenesis, and vertical transport of organic matter in the oceanic environments.