First Transmission Electron Microscope analyses of nano-sized particles produced by IR femtosecond Laser Ablation

F.X. D'ABZAC[1]*, A.M. SEYDOUX-GUILLAUME[1], F. POITRASSON[1], R. FREYDIER[1] AND L. DATAS[2]

[1]LMTG, CNRS, 14 av E. Belin, 31400 Toulouse, France. (*correspondence: dabzac@lmtg.obs-mip.fr)

[2]Université de Toulouse – TEMSCAN – CIRIMAT, 118 rte de Narbonne, 31400 Toulouse, France

NIR femtosecond laser ablated particles were collected for Transmission Electron Microscopy analyses. Natural Monazite single crystal (Moacyr, Itambe, Brazil), Zircon (Mudtank), NIST 610 glass standard, Quartz and a Silicon wafer were studied.

Two types of amorphous particles were observed: <1µm clusters of 5-20nm particles and 10-100nm round shaped beads. These features are observed in all samples, regardless of their nature or bulk composition. However, qualitative analyses using Energy Dispersive X-Ray Spectroscopy (EDX) show that they are chemically fractionated according to the original solid composition.

Increasing pulse duration from 60fs to 3ps or reducing energy from 1mJ/pulse to 0.1mJ/pulse tends to reduce the number of particles (smaller ablated volume) and to increase the predominance of round beads.

We observe that the essential part of aerosols is collected during the first third of ablation time. The generation of a plasma above the target surface and its shockwave propagation may be at the origin of the decrease in the amount of aerosols exiting the ablation cell when craters become deep enough[1]. Up to now, mechanisms responsible for the elemental fractionation of laser-induced aerosols remain unclear in the femtosecond regime. Element-dependent saturation vapor pressure during the condensation step of the expanding plume may be one of the main parameters involved[2]. But the refractory character of species or their ionization potential might affect the process as well.

[1] Koch *et al.* (2008) *Spectrochimica Acta Part B: Atomic Spectroscopy* **63**, 37-41. [2] Hergenröder (2006) *Journal of Analytical Atomic Spectrometry* **21**, 1016-1026.

Methane fluxes from the soils in active volcanic areas: the case of Pantelleria Island (Italy)

W. D'ALESSANDRO, S. BELLOMO, L. BRUSCA, M. LONGO, M. MARTELLI AND G. PECORAINO

Istituto Nazionale di Geofisica e Vulcanologia, Palermo, Italy (w.dalessandro@pa.ingv.it)

Methane, the most abundant hydrocarbon in the atmosphere, plays an important role in the Earth's atmospheric chemistry and radiative balance being the second most important greenhouse gas after CO_2. Methane is released to the atmosphere by a wide number of sources, both natural and anthropogenic, with the latter being twice as large as the former [1]. It has recently been established that significant amounts of geological methane, produced within the Earth's crust, are currently released naturally into the atmosphere [2]. Among natural sources the volcanic/geothermal emissions are probably the least constrained. Recent estimations for volcanic and geothermal systems in Europe [3] gave a rather large provisional range (4-16 kt/a) that claims for much more field measurements in order to widen the current database and decrease the present uncertainties.

Pantelleria is an active volcanic complex, at present in quiescent status, hosting a high enthalpy geothermal system. Explorative geothermal wells tapped an exploitable water-dominated reservoir at 600-800 m depth with maximum measured temperatures of 250°C. While some data are available on diffuse CO_2 fluxes, data on CH_4 are available only for fumarolic fluids.

In the present study we measured CH_4 fluxes in the area of Favara Grande characterized by intense diffuse degassing and widespread signs of geothermal activity (fumaroles, steaming grounds and large zones devoid of vegetation). Values range from negative (-43 to 0 mgCH_4 m^2 day), typical of soils with methanotrophic activity, up to 3500 mgCH_4 m^2 day in the most thermalized area. The preliminary estimate of the methane release from the area of Favara Grande is about 2.5 t/a. Extrapolation to the whole volcanic/geothermal system of Pantelleria gives about 10 t/a.

[1] Kvenvolden & Rogers (2005) *Mar. Petrol. Geol*. **22**, 579-590. [2] Etiope (2004) *Atm. Environ.* **38**, 3099–3100. [3] Etiope *et al.* (2007) *J. Volc. Geotherm. Res*. **165**, 76 – 86.