

## **Volcanogenic Air Pollution and Respiratory Health Effects**

**Patrícia Garcia<sup>1</sup>, Diana Linhares<sup>2</sup>, Armindo Rodrigues<sup>2</sup>**

University of Azores, Department of Biology, <sup>1</sup>CITA-A/GBA/ <sup>2</sup>CVARG  
Rua da Mãe de Deus Apartado 1422, Ponta Delgada, Azores, Portugal  
patriciag@uac.pt; dlinhares@uac.pt; rodrigues@uac.pt

### **Extended Abstract**

#### **Background**

Volcanic activity is a natural source of pollutants, particularly of the air, such as particulate matter, toxic gases and heavy metals. Many studies have established an association between exposure to anthropogenic air pollution and human health, but the impact of chronic exposure to volcanogenic air pollutants is poorly known. Despite all the hazards associated with the activity of volcanoes, the richness of the soils in nutrients increasingly attracts people to live on or in the vicinity of active volcanoes, as it happens in the Azores archipelago (Portugal), oceanic islands of hotspot volcanism. The largest island of the archipelago is São Miguel, with three major active central volcanoes (Sete Cidades, Fogo and Furnas). Furnas Volcano activity is marked by several hydrothermal manifestations consisting of active fumarolic fields, thermal and cold CO<sub>2</sub> springs and soil diffuse degassing areas (DDS) that produce and release hazardous gases and heavy metals in a daily basis. Furnas and Ribeira Quente are two villages built on Furnas Volcano DDS areas. Previous studies evidenced that Furnas inhabitants have a high incidence of chronic bronchitis and of some cancer types (Amaral and Rodrigues 2007; Amaral et al. 2006) and, a higher risk of DNA damage in human buccal epithelial cells (Rodrigues et al. 2012). However, to our knowledge, up to date no study was carried out to assess the association between volcanogenic DDS and the risk of development of respiratory defects.

#### **Objective**

This study aimed to evaluate whether human chronic exposure to volcanogenic soil diffuse degassing is a risk factor for human restrictive and obstructive (COPD) respiratory diseases.

#### **Methodology**

A cross sectional study was performed in 150 inhabitants of Ribeira Quente village (study group) and a reference group of 383 individuals inhabiting an area without soil degassing. Lung function and Tiffeneau-Pinelli index were measured by spirometry test. Data were analyzed with logistic regression models, adjusting for confounding factors.

#### **Main Results**

Prevalence of restrictions and of COPD were significantly higher in the study group than in the reference one. Chronic exposure to volcanogenic soil diffuse degassing was significantly associated with higher prevalence of respiratory restrictions and COPD exacerbation. The risk of having a restrictive respiratory defect was significantly increased in the study group (3.55 times higher), as well as the risk of COPD exacerbation (3.96 times higher).

Conclusion: For the first time it is evidenced that chronic exposure to volcanogenic soil diffuse degassing is a risk factor for restrictive and obstructive (COPD) respiratory defects, particularly in middle-aged and elderly persons and individuals with asthma.

## References

- Amaral A., Rodrigues A. (2007). Chronic exposure to volcanic environments and chronic bronchitis incidence in the Azores, Portugal. *Environ Res*, 103: 419-23.
- Amaral A., Rodrigues V., Oliveira J., Pinto C., Carneiro V., Sanbento R., Cunha R., Rodrigues A. (2006). Chronic exposure to volcanic environments and cancer incidence in the Azores, Portugal. *Sci Total Environ*, 367 (1): 123-128.
- Rodrigues A., Arruda M., Garcia P. (2012). Evidence of DNA damage in humans inhabiting a volcanically active environment: a useful tool for biomonitoring. *Environ Int*, 49: 51-6.