

## **OBJECTIFS :**

The FAIVI (*Features of Acores and Italian Volcanic Islands*) research was addressed to twofold scientific objectives in the central Azores (mainly in Terceira island):

1) The study of peculiar and extremely uncommon eruptive products (lava balloons), produced by intermediate-depth submarine volcanic eruptions, through the comparison of two (of the 3-4 worldwide known) areas where this kind of products have been erupted, in historical (1891 at Pantelleria, Italy) and recent times (1998-2001 at Terceira, Azores). Lava balloons, firstly described in the scientific literature by Gaspar et al. (1999a and 1999b), are spherical to ellipsoidal blocks of lava consisting of a thin lava shell surrounding a closed interior hollow, normally corresponding to a single large vesicle, or a few large convoluted vesicles, that grant floatability to the balloon. They remain a fairly unusual volcanic product and their genesis is still under debate (Gaspar et al., 2003; Kueppers et al., 2008; Kueppers et al., 2009). The fact that lava balloons were produced on very different volcanic settings suggests that this phenomenon was not a fortuitous occurrence but rather a more frequent volcanic process than actually known. It is probably constrained by external factors (role of vapor, ambient pressure, water heat capacity, water density) and endogenous factors (geologic setting, character of magma and plumbing system). In order to constrain eruptive processes producing lava balloons and associated shards, the study of morphology of vents, the characteristics of volcanic shards and the quantification of the magma volatile contents and cooling rate are needed. The study is aimed at defining eruptive processes and physical conditions associated to the genesis of those products, possibly relating them to specific geomorphic features at the seafloor. Furthermore, this may lead to geohazard assessment for poorly known intermediate-depth submarine eruptions.

Main objectives of the investigations were:

- a) the precise identification and characterization of the emission centers associated with the 1998-2001 activity and other structures present in the Serreta ridge and in the surrounding area;
- b) the reconstruction of distribution of lava balloons, lava scoriae and volcanic shards related to the 1998-2001 eruption;
- c) the reconstruction of the submarine eruptive style and mechanisms producing lava balloons, in terms of magma ascent, degassing, cooling history and evolution processes;
- d) the comparison of the Terceira data with those of 1891 eruption at Pantelleria (Ricciò, 1892), one of the few sites in the world where similar products have been observed and for which a well-defined analysis, encompassing high-resolution bathymetry, dating and petrographic characterization, has been done by UNIROMA. The sampling and study of lava balloons and other eruptive products at Terceira is important, in fact, not only for reconstructing the dynamic of the Serreta event but also for comparison with similar (rare) kind of intermediate-depth submarine volcanic eruptions.

2) The analysis of small-scale prograding wedge-shaped sedimentary bodies, as those found at shallow depths (generally above -150 m) in selected coastal tracts around Italy (Chiocci et al., 2004) but also reported by literature on other geologically active regions (i.e. with volcanism or fault-controlled margins; García-Gil et al., 1998; Hernández-Molina et al., 2000; Casas et al., 2008; Ercilla et al., 2009; Roy et al., 1994) were studied in Faial by Quartau (2007), Quartau et al. (2010). These features have a terraced morphology, are located at a nearly constant depth below sea level, and display a prograding inner geometry. In Faial these were studied by Quartau (2007) and Quartau et al. (2010), but they could not be completely described in terms of their morphology because of the data coverage inadequacy of previous bathymetric surveys and poor quality of seismic data in terms of resolution and penetration. At Terceira the depositional bodies were never investigated, although their occurrence is suggested by the bathymetric maps.

The study of prograding wedges on the insular shelf has a great interest because they are quite poorly known in scientific literature, and in the fossil records they are often misinterpreted as beach deposits. Despite their wide distribution along different types of geological settings, in fact, physical processes driving their formation are only partially understood, especially the relationships with relative sea-level fluctuations. A better knowledge of these features will contribute to establish a shelf sedimentation model on volcanic islands. Moreover this scientific topic has got potential applied aspects for neotectonics, climate and ecological studies.

Main objectives of the investigations were:

- a) the characterization of the sedimentary facies and its spatial and temporal variability as well as habitat studies, as these bodies are usually the only flat and sandy seafloor in an otherwise uneven environment;
- b) the definition of depositional evolution and relative age of the prograding clinoform bodies lying on the insular shelf at Faial and Terceira, to relate them with eustatic cyclicity and local factors;
- c) the comparison with similar prograding bodies studied on different Italian volcanic insular contexts, to elaborate a comprehensive genetic and evolutionary model taking into account present and past coastal dynamics in wave-dominated coasts (including the role of storm wave-base, wave energy and fetch, etc.);
- d) the use of relict submerged clinoforms for neotectonic studies, in the same way as raised coastal terraces are used to underline crustal movements on coastal tracts.

As for the topics of the IOZOC project is concerned, the submerged slopes of oceanic islands host diverse communities of corals and other benthic fauna. Present knowledge of what factors govern the distribution of corals and other species which form these communities, or the level of interdependence between co-existing species, is limited. Our understanding of how resilient these communities are to human impacts is also rudimentary; we have only basic knowledge of how these animals reproduce, their fecundity, or how far their larvae can effectively disperse and settle

to replace adults that have died. The IOZOC project aims primarily to investigate what governs the distribution of animals on the seabed, and how they reproduce, grow and disperse. The Faial-Pico channel is the area of interest, where to acquire informations through video surveying on in situ settlement studies (using settlement panels), and population genetics studies of selected elements of the benthic community, to estimate resilience (at both community and population levels) to physical disturbance. Moreover, the final collection and analysis of 8 settlement panels from 4 stations was one of the objectives of the activities.