**ICE-VOLC PROJECT**

**Rationale**

Melbourne and Rittmann are volcanoes located in the Victoria land, and display fumarolic activity. The most recent eruption of Melbourne dates back to 1862-1922. Melbourne was discovered in 1841 by James Clark Ross, Rittmann during the 4th Italian Expedition (1988/1989). Our knowledge on both volcanoes is really little.

**Objectives**

The main objective of ICE-VOLC (multiparametric Experiment at antarctica VOLcanoes: data from volcano and cryosphere-ocean-atmosphere dynamics) project is the assessment of the state of health of Melbourne and Rittmann, and investigation of their dynamics.

The complementary objectives are:

(i) investigation of the relationship seismo-acoustic activity - cryosphere-hydrosphere-atmosphere dynamics.

(ii) evaluation of the impact of volcanic gas in atmosphere.

**ICE-VOLC ACTIVITIES DURING THE XXXII ITALIAN EXPEDITION**

The survey conducted as part of the geochemical research unit during the XXXII Antarctic Expedition (Nov-Dec. 2018) made possible the identification, mapping and geochemical investigation of ice-caves of fumarolic origin. Ten of these were at Melbourne and one at Rittmann volcanoes, where in most cases it was possible to explore and carry out gas sampling in the hotter parts of the ground. Further gas sampling was also carried out in exposed fumarolic areas on the surface.

A total of 66 volcanic gas samples were collected during the XXXII Expedition.

**GEOCHEMISTRY**

Phases of gas sampling. Left: subaerial fumarolic area of Melbourne, right: gas sampling inside an ice-cave at Melbourne.

Illustrating the alpine-spineological techniques used in order to explore the ice caves of fumarolic origin.

**VOLCANOLOGY**

Map showing the location of the sites where we collected rock samples.

During 10 January – 6 February 2017, the following volcanological activities were carried out:

- Survey of Mt. Melbourne and Rittmann to identify outcrops in the deglaciated areas.

- Description and measurements of stratigraphic sections.

- Collection of scoria bombs on the Mt. Rittmann crater rim.

- Collection of 5 samples of ash within the glaciers on the east flank of Mt. Melbourne.

- Collection of 30 samples of pumice, lava bombs, scoria from Mt. Melbourne.

**SEISMOLOGY**

Ice-quakes

During forty days of acquisition in Teryt Bay, three ice-quakes were detected, with dominant low frequencies (below 2 Hz). By using the signals recorded by 18A and VND stations (available in the IRIS website: www.iris.edu), these events were located in the David Glacier area with local magnitude of 2.6-2.8. These events were likely to have been generated at the rock-ice interface under the glacier.

**Microseism**

By analyzing 14 years of seismic signals recorded by 3 stations installed along the Ross Sea coasts, we quantitatively investigated the relationship between microseisms recorded on the coasts of the Ross Sea, sea ice concentration in the Ross Sea and significant wave height in the southern hemisphere. We show how, according to the 9-12t meters seismic station and frequency band, the area characterized by the strongest anti-correlation between microseism amplitude and sea ice concentration is distinct. We also note how the oceanic areas, whose wave activity mostly affects the microseisms recorded in the Ross Sea, are the Antarctic coasts close to Ross Sea and the Drake Passage.

**Seismicity on volcanoes**

Ten days of seismic recordings on Rittmann allowed distinguishing two classes of seismic events:

- Low-frequency events characterized by low frequency peak and mean frequency, long duration, high polychromaticity, and slightly higher seismic RMS and peak-to-peak amplitudes.

- High-frequency events characterized by higher frequency peak and mean frequency, short duration, high polychromaticity, and slightly lower seismic RMS and peak-to-peak amplitudes.

Examples of low-frequency (a) and high-frequency (b) events recorded, with corresponding STF (c,d).