

Volcanic eruptions at the rate of the lunar phases

Source : Unione Astrofili Italiani

The influence of the Moon on the earth and on the human beings is a recurring argument in the history of the science since the time of the most ancient civilizations. Recurring but controversial, by leaving aside the popular faiths which attribute to the lunar phases some effects for example on the growth of plants, on the abundance of sea fish, or on the human birthrate, even if some physical phenomena potentially sensitive to the lunar influence vary certainties and doubts expressed in qualified scientific publications.

This important reason provoked a new research under the leadership of geologists Gianluca Sottili (CNR Roma) and Danilo M. Palladino (Sapienza Roma), who announce the clear evidence of a modulation of the eruptive activity of Stromboli by the lunar tides.

The study was published on "Terra Nova", a prestigious international revue which distinguishes itself by propositions of innovative arguments in the field of the Earth sciences, with the title: "Tidal modulation of eruptive activity at open-vent volcanoes : evidence from Stromboli, Italy" (02/21/2012)

The scientific researches, in the modern sense, on the correlations Moon-Volcanoes, count henceforth almost one and a half century. We really owe to an Italian, Luigi Palmieri (1807-1896), geophysicist and director of the of Vesuvius observatory, the first observation brought reported by the scientific literature that the effusivo-strombolian eruptions of Vesuvius often occur in concomitance with the full moon, and thus with the tide. Since then dozens studies were dedicated to similar searches on various volcanoes (Kilauea, Mt St Helens, Mayon, etc.), A few finding significant correlations, others even finding nothing.

The reason for which the Moon can in some way influence the volcanic eruptions is intuitive but not for it indisputable. Both in the full moon and in the new Moon, that is with a cadence about 14 days, the earth undergoes the maximum of gravitational effect, of in the adaptation Sun-Earth-Moon which puts itself in evidence on seascape masses with the phenomenon of the tide, the visible way by all; and on the solid part of the earth, invisible but instrumentaly detectable . Can it have consequences on the burst of lave and other symptoms, or on the other demonstrations of the volcanic activity? In other words, the order of height of the gravitational forces which exercise, in these circumstances, on the volcanic systems is it such as it can arouse certain types of effects?

The unique reliable answer can come from sharp statistical analyses on a big number of eruptions of active volcanoes, so as to be able to bring to the foreground coincidences without ambiguity with maximal events of tide. It is what made Sottili and Palladino subjecting to the riddle 17 months of activity of Stromboli, from June, 2010 till October, 2011, hanging which ones were (recorded more than 150.000 explosions in craters situated at the top of the volcano in approximately 900 metres over the sea level.

The explosive events can seem numerous with regard to the period of observation, but really this is the peculiarity of the most northerly volcano of the Eolian Islands: on average an explosion every five minutes (12 at the hour). Because of its characteristic persevering activity, Stromboli is thus a perfect candidate for an effective statistical study.

Known since the antiquity as the Lighthouse of the Mediterranean Sea, because it emits visible lights by far, especially the night, Stromboli owes the high frequency of its explosions to the fact that in the craters of the summit levels a little sticky magmatic fluid in which are dissolved small bubbles of gas.

In every package of minutes, when the pressure of gases exceeds the one of the liquid then occurs a spectacular explosion accompanied by called "fountains of lave" that is by a projection of small fragments of magma in all directions.

The hourly frequency of the explosions is not constant but crosses periods of minimum with 5 to 8 events, and periods of maximum with 20 to 22 events. In a graph which represents the number of the explosive events of Stromboli according to time it is thus possible to easily individualize the maximum peaks of activity.

So, by leaving data registered by the network of control managed by the National Institute of Geophysics and Vulcanology (INGV), both authors of the study above put in evidence the stunning coincidence between the maximum peaks of the Strombolian activity and the phases of the full or new moons, that is the maximal concomitances of the tide.

Sottili and Palladino did not limit to demonstrate the "modulation of tide" of the Strombolian activity, but they also formulated a hypothesis on the mechanism which makes it possible. Having estimated that the constraint of tide on the volcanic system is one thousand times lower than the pressure which causes the explosions, they exclude a direct baiting of the simple explosive events and propose rather the alternation of compression and decompression on the taking rock so as to modulate the degassing of the magma.

From our observations, conclude the authors, we can deduct that in a system having a persevering activity as that of Stromboli, tides do not stimulate the event of the simple explosions but rather intensify the volcanic activity by increasing the frequency of the explosions.

In fact the increase until 85 % of the number of the explosions per hour that is with an average from 12 to 20-22 arrives in concomitance with the maximal tides which come true every 14 days.

Legends of figures

- 1) The number of the explosive events per hour of Stromboli (on the graph indicated by red triangles) seems strictly correlated to the new and full moons, that is with the maximal tides.
- 2) The most northerly island of Stromboli of the Wind Islands and in the small red circle the sommital crater seat of an average of a dozen explosions per hour, modulated by lunar tides.
- 3) In helicopter on "Sciarra del Fuoco" of the island Stromboli during the paroxystic explosive eruption of January, 2003 (photo Foresta Martin).
- 4) The lave of Stromboli dives in sea during the eruption of January, 2003 (photo since the door of the helicopter in flight on " Sciarra del Fuoco " (photo Foresta Martin).