

Study of the Vulcanian explosions at Volcán de Colima, México, from seismic signals

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My presentation consists of two parts: *Overview of the 1997-2006 eruption at Volcán de Colima* and *Seismic signals of Vulcanian explosions*. In the first part I present the general characteristics of the 1997-2006 activity at Volcán de Colima, México. The eruption developed into four stages, one pre-lava stage and three stages of andesitic block-lava extrusions with the building of lava domes accompanied by the sequences of intermittent Vulcanian explosions with the destruction of these lava domes. In the second part I present some results of the study of the Vulcanian explosions from broadband seismic records. A typical broad-band seismic record of Vulcanian explosion consists of two impulses, of low-frequency (LF) and high-frequency (HF) contents. I propose a conceptual model that considers the LF seismic signal as being generated by the vibration of the magma conduit during the upward flow of fragmented magma, while the HF seismic signal is generated by the explosion at the surface. A methodology is proposed for the quantification of volcanic explosions based on three parameters derived from broadband seismic signals: the counter force of the eruption F , the power of the explosion P , and the duration of the upward movement of the fragmented magma in the conduit to the surface D . The broadband records of more than 100 explosive events were obtained at a distance of 4 km from the crater. I determined the counter force of the eruption by modeling the low-frequency impulse of the seismic records of 66 volcanic explosions and estimated the power of 116 explosions from the spectra of the high-frequency impulse for the 2004-2005 sequence of explosions at Volcán de Colima. The power of Colima explosions spans 5 orders of magnitude; the counter force spans 4 orders of magnitude. I show that the power of a volcanic explosion is proportional to the counter force of the eruption. These parameters may be used for the elaboration of a scale of volcanic explosions. Then I define the time

D , representing the movement of fragmented magma, as the time from the beginning of LF impulse to the beginning of HF impulse depending on the depth of fragmentation. Observations at two andesitic Mexican volcanoes: Volcán de Colima and Popocatepetl, indicated three depth levels for the beginning of the vertical movement of fragmented magma in the conduit at different stages of the eruption. The D values observed before significant Vulcanian explosions at both Mexican volcanoes are close, indicating similar depths of magma fragmentation.