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Very Long Period (VLP) seismic signals recorded at Mount Etna Volcano, Italy

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A marked anomaly in the tremor signal recorded at Etna Volcano occurred between the 16th of December 2005 and the 13th of January 2006. The amplitude of the volcanic tremor started rising by November, 2005 climaxed by the 17th of December, and was then followed by the occurrence of three-hours cycles. This anomalous period ended on the 12th of January 2006, after an energetic explosion which occurred on the summit craters zone (the seismic signal was recorder till Ustica island, north of Palermo). No eruptive activities were observed during this period. Through an automatic detection procedure applied to the continuous data stream from Etna's broadband seismic network during the aforementioned time interval, we recognized more than 10000 Very Long Period (VLP) events. These events depict a dominant period of about 20 seconds, and rapidly attenuate moving away from the summit craters. These events were clustered in three groups of similar events, using methods based on cross-correlation analysis. The analysis of the temporal distribution of individual families shows a different rate of occurrence in time. For each family, the marked waveform similarity suggests the action of a repetitive, non-destructive source process. Polarization ellipsoids generally depict a radial orientation to the direction pointing to the summit zone, and incidence angles clustered over the 55°-60° interval. During January, 2006, the incidence angles augment markedly, suggesting a swallowing of the source. In analogy with other basaltic system, we interpret the VLP activity in terms of the elastic response of the summit plumbing system to unsteady mass movement. Under such conditions, the observed migration of the source may be explained by invoking: a) a variation in the magma reology and/or gas content; b) a change in the conduit

geometry, possibly associated with structural damages following the violent explosive episodes; c) a variation in the height of the top of the magmatic column. Constraints on these possible interpretation will be possible after future analyses aimed at better elucidating the nature and source mechanism of these signals, in turn comparing their evolution with other geophysical and geochemical observables. Nonetheless, this study represents the very first effort toward the tracking of VLP sources dynamic on this active volcano.