Geophysical Research Abstracts
Vol. 12, EGU2010-13252-1, 2010
EGU General Assembly 2010

Volcaniclastic facies architecture of a long-lived, nested silicic tuff ring: the Los Loros volcano, Mendoza, Argentina

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Los Loros is a small, well-preserved volcanic depression. New K/Ar age dating revealed that the volcano is least 1 million years old. The circular morphology of the ∼50 m deep and ∼ 1 km broad crater of Los Loros was initially inferred to be of phreatomagmatic origin. Recent work, however, concluded that Los Loros is a far more complex volcano than originally thought; with multiple eruptive phases produced by magmatic and minor phreatomagmatic explosive fragmentation-dominated eruptive processes that consequently formed a low aspect ratio volcano. Previous work also suggested that volcanic rocks of Los Loros were entirely basaltic in composition (Puente Formation) and their age was mid-upper Pleistocene. Newly obtained geochemical data, alongside a new age determination, underlies the fact that the volcano is far older than had been expected from its morphology, and its composition shows no signs of basalt, instead it is trachytic.

The volcanic succession forms a ∼100 m thick pile sitting directly on Cretaceous continental red beds. The base of the volcanic succession is a polymict volcaniclastic conglomerate with variable bed thickness and occasional cross stratification, indicating a channel-filling nature and an origin from a braided river system. The diversity of the clasts suggests that they likely have been transported from a nearby Miocene back-arc volcanic complex, the Sierra Cachahuén (∼40 km), which is a lava dome dominated multiple volcano with thick silicic pyroclastic successions.

The volcaniclastic conglomerate is covered by a trachytic pumiceous unit thickening toward the SSE. They are composed of loosely packed rounded pumice lapilli. These beds have a well-sorted texture with no characteristic internal stratification, indicating that they are fall in origin and the bed thickness variation is inferred to reflect the paleo-wind direction. A thick pile of pumiceous tuff (up to 20 m) overlies the basal pumice fall unit. It is stratified, cross-bedded and having erosional contacts to the underlying pumice fall beds suggest deposition from high particle concentration pyroclastic density currents. This succession is inferred to represent an original pumice ring formation in a braided river network, where external surface and shallow sub-surface water were available to influence the eruption, causing slight phreatomagmatic affinity.

This initial volcaniclastic succession is covered by immature, but thick (dm-to-m) pelitic palosoils and/or channel-filling volcanic conglomerates, suggesting a significant time break (tens of thousands of years), erosion and landscape resetting by fluvial networks after the pumice ring was formed.

The rejuvenation of the volcanic vent is represented by a thick pyroclastic and lava capping unit. At least three units of trachytic pyroclastic breccias can be separated on the basis of their welding textures and pumice-to-lithic ratios. The gradual transition from stratified trachytic pumiceous beds to welded units indicates that these units are formed from laterally moving pumiceous pyroclastic density currents (e.g. small-volume ignimbrites). The topmost unit of Los Loros is a trachytic lava flow, which is well-preserved in the East. Monomict volcanic conglomerate covers the eastern sector of the lower slopes of Los Loros, suggesting long-lasting alluvial deposition since the volcanism. The eruptive sequence preserved at Los Loros indicates an initial pumice ring formation on an active alluvial plain. The significant time gap between the basal and capping volcanic units suggests a long-lasting inter-eruptive period prior to resumption of volcanic activity, forming small-volume, low aspect ratio trachytic ignimbrites and capping lava flows.

Los Loros is a unique volcano in the sense that it “mimics” a tuff ring in its morphology and geometrical parameters; however, its eruptive sequence is more typical to those eruptions associated with large-volume silicic composition volcanoes with significant inter-eruptive periods.