

GEOLOGY AND PALINOLOGY OF THE SANTA CLARA KIMBERLITE MAAR. COROMANDEL, BRAZIL.

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Introduction. The Santa Clara kimberlite lies at the Fazenda da Mata, SW Coromandel on the headwaters of the Santa Clara creek. It is part of the Upper Cretaceous Alto Paranaíba Igneous Province which includes lavas, tuffs and feeder intrusions of the Mata da Corda group, the carbonatite complexes of Catalão, Salitre, Serra Negra and Araxá and hundreds of scattered intrusions of kamafugite, lamproite and kimberlite (Bizzi, 1994; Gibson et al., 1995). The Santa Clara kimberlite was recognized at the surface by the presence of silicite outcrops that limit its southeastern border, by the presence of strongly weathered kimberlitic breccia in a small gully and in the walls of a water well and by scattered vermiculite, wine-red pyrope and picroilmenite crystals that are found within the lateritic soils and termite mounds. There is no surface indication as to the presence of a 100m sequence of lake sediments underneath or any geomorphological feature that would indicate the maar structure.

Geology of the Maar. The Santa Clara crater structure was outlined only after the drilling of two 100m deep bore-holes, spaced 100m apart and 100m from the contact with the host rocks. The structure is an elliptical-shaped 400m long x 180m wide x 120m deep flat-bottom crater structure hosted by quartz-carbonate-chlorite schists of the Ibiá Group. The crater was filled by a rhythmic succession of delicate, finely interlayered varves of black shales and light-colored phlogopite-bearing siltstones that characterize the seasonal lake sedimentation (Leonardos et al., 1994). The bedding varies from flat-lying to steep-dipping to convolute. Coarse-grained epiclastic kimberlitic breccias (EKB) constitute about a third of the sedimentary sequence and record periods of depositional instability. The EKB occur as numerous and irregular centimetric to metric intercalations within the shales and siltstones and attest to the presence of an outer ring of pyroclastic kimberlitic source material. Synchronous centimetric layers of massive pyrite occur largely in black shales and the varvitic sequence. These facies characterize periods of quiescence between volcanic eruptions with a very low redox potential and low-energy stagnant deep lacustrine sedimentation. A few thin intercalations of gypsiferous layers record dry periods after shallow sedimentation.

Magmatic tuffitic kimberlite breccia (TKB) begins at 60m below surface, as 10m thick levels interlayered with shales and EKB. Except for its apparently extrusive emplacement, texturally the rock resembles a typical diatreme facies. TKB is formed by abundant angular well preserved country rock xenoliths, mineral fragments and xenocrysts of wine color pyrope, orange color eclogitic garnets, altered phlogopite and

ilmenite. The olivine macrocrystals are all serpentinezed. Local carbonatization occurs leaving the TKB with a pelletal aspect. There are distinct kimberlitic pulses, since the TKB besides being interlayered with crater sediments also crosscuts the sediments. We conclude Therefore that the two drill core intercept the margin of an explosive structure that resembles an open champagne glass without a typical diatreme. This suggest that the the hydrodinamic conditions are more important in constructing maar structures than the magma type (Lorenz,1985).

Kimberlite index minerals. Garnets, ilmenites and chromites were separated and analysed on the Cameca SX-50 microprobe. Of the 400 garnet xenocryst population, 82.1% were plotted as high Cr-Ca G-9 garnets, characterizing a strong lherzolitic trend, with Cr₂O₃ values varying from about 2 to 11 wt%. The other garnet populations comprised G 10(4.0%), G-13(0.5%), G-1(8.8%), and G-3(4.6%). This last type shows high Na₂O content(> 0,07). The ilmenites show MgO and Cr₂O₃ in the range of 5 to 12 wt% and 0.2 to 4.1% respectively. Most chromites have Cr₂O₃ in the range of 35 to 60 wt% with MgO between 10 and 15 wt% that could be assigned to the lherzolite trend. A small but significant population has very high Cr₂O₃ values of 60 to 65 wt%. Apparently, only a small portion of strongly depleted harzburgite was sampled suggesting that the Cretaceous lithosphere in this region, was formed mainly by spinel and garnet lherzolites with pods of eclogite.

Palinology. 38 drill-core samples were collected for pollen determination from depths ranging from 18 to 101m. The palinological associations throughout the sedimentary pile have shown little biodiversity. The following main palinomorphic taxa were recognized: Aucariacites spp., Triporoletes blanensis, Hexaporotricolpites emelianovi, Gnetaceaepollenites jansonii, Gnetaceaepollenites spp., Classopolis classoides, Cretaceaiporites polygonalis, Retitricolporites belmontensis and Tricolpites spp. Undetermined fungi and triletes spores are associated with it. Leaves of dicotyledonia plants are well preserved as macrofossils. The widespread presence of poliplicated pollen grains and the nature of the sedimentological record suggest an arid tropical climate at the time of deposition. Associations that contain the above mentioned taxa are found in nearly all Upper Cretaceous sections of all Brazilian marginal basins (Regali, et al.,1974), and give us the necessary information to infer with certainty a Conacian to an Early Campanian age (80 to 85 Ma) for the lacustrine sedimentation within the Santa Clara maar. These ages fit exceedingly well with K-Ar and Ar-Ar determinations of ~85 Ma provided by Gibson et al.(1995). The stratigraphical and palinological record within the several dozens of Upper Cretaceous kimberlite maars that must be present within the Alto Paranaíba magmatic province may provide important clues as to the paleoclimatic and biodiversity evolution of the Upper Cretaceous in continental South America.

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