CRYSTAL SIZE DISTRIBUTION (CSD) OF MAFIC SILLS AND DIKES OF THE EASTERN BORDER OF PARNAÍBA BASIN, NE BRAZIL

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ABSTRACT: We combine crystal size distribution and plagioclase and clinopyroxene compositions to investigate the crystallization processes of Mesozoic mafic subvolcanic intrusions of the eastern margin of the Parnaíba Basin. The diabases consist of plagioclase, clinopyroxene and opaque minerals (Fe–Ti oxides) as common crystallizing phases while sulphides and rare olivine are accessory minerals. Chemically they are sub–alkaline basalts, alkali basalts, basaltic trachyandesites, trachyandesites and trachytes, which display tholeiitic affinity and sub-alkaline to alkaline signature. These rocks normally record two types of textures: (i) holocrystalline intergranular varying from porphyritic to glomeroporphiritic and (ii) hypocrystalline in that microphenocrysts of plagioclase and clinopyroxene are included in a groundmass of fine–grained microlites (devitrified) that may contain small glass volumes. CSDs of holo- and hypocrystalline types are similar, with plagioclase usually recording nearly log-linear slopes in grain-sizes above 0.3 mm. Below 0.3 mm, however, the plagioclase CSD slopes are steeper in agreement with faster nucleation of microlites. Anorthite content in coarser plagioclase vary from bytownite to oligoclase and from labradorite to albite (including locally K-feldspar) in the finer (microlitic) grains. Coarse plagioclase normally shows anorthite content between An_{84} and An_{25} from center to the margin of the grain, although some grains record an alkali-rich rim (albite to sanidine) in apparent disequilibrium with the inner more calcic crystal. CSD slopes of pyroxene are steeper than plagioclase and its average grain-size smaller. They consist of augite (dominant) and pigeonite and show compositions which are relatively uniform across the crystal. Unlike plagioclase, pyroxene CSDs tend to be deficient in finer crystals. This may indicate that at the latest stages of crystalization the clinopyroxene CSD was modified by mechanical processes that would have dissolved the smaller grains to incorporate them into the larger ones. CSDs, therefore, are consistent with a steady simple crystallization history for the eastern margin of the Parnaíba mafic intrusions. Late, highly fractionated alkaline-rich melts would promote disequilibrium textures rimming the early calcic plagioclase and crystallize Na-K-rich microlites on quenching of the magma.

KEYWORDS: PETROGRAPHY, CSD, TEXTURE, EQUAMP