Combined textural, petrological and geochemical information provide new insights into the pre-eruptive magmatic processes and source evolution occurring prior-to and during two catastrophic caldera forming eruptions (Lower and Upper Pumice) on Nisyros, Greece. Co-magmatic cumulates, representing disrupted crystal mushes, are contained as plutonic nodules within the pyroclastic deposits of the Lower Pumice. The cumulates have bulk SiO$_2$ ≤46 wt%, and mineral assemblages (plagioclase An$_{85-96}$, olivine Fo$_{74-77}$, pyroxenes Mg$_{62-85}$, ± amphibole Mg$_{57-74}$) and compositions consistent with derivation from water-rich (3.7-8.4 wt% H$_2$O) basaltic melts likely to be parental to the Nisyros silicic magmas. Ion-microprobe analyses of dissolved volatiles (CO$_2$ and H$_2$O) in melt inclusions (MIs) from the rhyolitic pumices and cumulate xenoliths are used to constrain volatile pressure at the time of entrapment and, in turn, provide information on depth(s) of magma storage and over which magmatic differentiation occurred. Glass analyses range from 56-75 wt% SiO$_2$ with a large proportion having intermediate compositions which fill the previously reported 'silica-gap' in Nisyros' whole rock compositions. Interstitial glasses (trachyte-rhyolite) are more evolved than MIs (trachybasaltic-andesites – trachyte) irrespective of the host rock. Amphibole-thermobarometry indicates temperatures of 793-1033°C and pressures of 527-160MPa, with more mafic compositions clustering at mid-crustal levels ~500MPa. Chemical comparison of the cumulates and volcanic rocks of Kos-Nisyros reveals the presence of two distinct magmatic suites (defined on the basis of FeO and trace elements); the cumulates testify to partially solidified remnants from one lineage being disrupted and entrained in the other over a wide pressure range within the crust below Nisyros.