The thermal state of pyroclastic flow deposits, 4.6 ka Fogo A plinian sequence, São Miguel, Azores, using TRM analysis and charcoal reflectance data: implications for eruption and flow processes

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The Fogo A plinian eruptive sequence is characterised by a complex stratigraphy, constituted by an initial Plinian fallout deposit of white trachytic pumices, followed by two intraplinian ignimbrites and one last main ignimbrite, which is dominated by more basic dark pumices, interstratified within the plinian fallout sequence. The aim of this research is to reconstruct the emplacement temperatures of the three ignimbrites and assess the factors that have influenced these. Emplacement temperatures of the three ignimbrites of the Fogo A plinian sequence, have been investigated using thermal remanent magnetization (TRM) of lithic clasts and a relatively new method of using charcoal reflectance of charcoal fragments embedded within the deposits. A total of 132 oriented lithic clasts from the three ignimbrite deposits, were collected from 15 localities distributed around Fogo volcano. The clast population is dominated by lava trachytic clasts and subordinate syenite clasts. The TRM analyses show the emplacement temperatures of the two intraplinian ignimbrites were respectively greater than 400 and 580textdegree; while the temperature reached by the final ignimbrite was 300 to 350textdegree. These thermal estimations are supported by the results of the analysis of inertinite-like maceral reflectance within the charcoal fragments entombed in the ignimbrites. The reflectance of 17 samples of charred fragments that the temperature reached by the wood fragments in the first intraplinian ignimbrite correspond to a temperature of 400 to 450textdegree, whereas the R% = 0.85 of the last ignimbrite indicate temperatures of 300 to 350textdegree. The different temperatures for the ignimbrites can be explained by a combination of componentry, especially lithic clast content, collapse level in the eruption column, turbulence level of the pyroclastic flows, degree of incorporation of water vapour from volatilised vegetation, and degree of topography confinement by the pyroclastic flows. The results also show that TRM and charcoal reflectance methods give comparable results, indicating that either method can be used depending on the characteristics of ignimbrites and availability of facilities.