Petrology of quartz syenite and hauyne syenite clasts from the Pitigliano Formation, Latera caldera, Vulsini District, Central Italy

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Abstract: The textures and mineralogy of quartz syenite and hauyne syenite clasts within the phonolitic (pyroclastics) to tephriphonolitic lavas Pitigliano Formation indicate different origins and separate cooling histories. Whole-rock geochemistry of both quartz syenites and hauyne syenites indicates they are slowly cooled equivalents of differentiates of potassic magmas, approximately retaining a liquid composition. Clinopyroxene and amphibole compositions reflect the higher and lower silica activity of the melts from which the two suites crystallized. The foiditic syenite clasts, cognates with the Pitigliano Formation host-rocks, are inferred to have grown at shallow depths, as side-wall or roof cumulates (ideal orthocumulates) near the top of a chamber containing a HKS phonolitic-terephriphonolitic magma. By contrast, the quartz syenite clasts are inferred to be xenoliths of older rocks from deeper parts of the magmatic system crystallized from KS-trachytic magmas.

There is little variation with respect to \(^{143}\)Nd/\(^{144}\)Nd and \(^{87}\)Sr/\(^{86}\)Sr ratios in the two syenitic suites. These ratios lie within the ranges shown by the mafic lavas of Vulsini, implying that no significant crustal contamination by siliceous material occurred beyond the mafic stage of evolution. The hauyne syenites, however, have relatively high \(\delta^{34}\)S values (between +10.4 and +12.9 \(^\permil\)), which are believed to reflect assimilation of underlying Triassic evaporites with \(\delta^{34}\)S values of ca. +14.3 \(^\permil\). Evidence from SO\(_2\)-rich apatites and the mineral chemistry of some pegmatite clasts appears to confirm that sulphur-rich fluids emanating from the Triassic carbonate-evaporite sedimentary wall-rock sequences contaminated the crystallizing HKS magma.

Key-words: igneous petrology, syenites, potassic magmas, magma chamber, crustal assimilation, Latera caldera, Vulsini Volcanic District.

Introduction

Throughout the northern part of the Roman Volcanic Province, including the Vulsini District, a wide compositional spectrum of volcanic rocks is closely associated in time and space. These comprise the potassic series (KS) and the high potassic series (HKS) which have been exten-