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Piperno from Campi Flegrei (Italy): a valuable historical stone

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Piperno represents the most used stone in the historical architecture of Naples and many other minor centres of Campania region. Notwithstanding the reduced extension of the deposit and the difficulty of exploitation (mainly performed underground), it had been used and intensively from the 18th century until the first decades of the 20th century, mainly in Naples and its province. However, its use was also recorded in many other minor centres and even outside the region: in fact, architectural elements made up of Piperno were found in some historical buildings in the town of Gallipoli (province of Lecce, Apulia region). Due to the historical relevance of the stone and in order to preserve its old exploitation sites, researches aimed at defining the mineralogical and petrophysical features of this material and at surveying the underground sites were carried out at the Earth Science Department of Naples University and within the activities of the "Progetto Dimostratore Campi Flegrei of the Centro Regionale di Competenza - INNOVA". The Piperno, a formation about 39.000 years old, is characterized by a peculiar eutaxitic texture with black collapsed scoriae (flattening ratio 1:10) set in a light gray ashy matrix. The main mineralogical constituent is sanidine along with subordinate plagioclase, clinopyroxene, biotite, amphibole, magnetite and sodalite. Sanidine often exceeds 80 % and is only partially pyrogenic; most of it is the product of the devitrification process affecting the deposit after the emplacement. The eutaxitic texture gives the rock a peculiar design, as a function of the direction of the cut (verso or secondo), that makes this rock particularly valuable for the production of slabs, columns and other architectural elements. From a petrophysical point of view

Piperno shows a wide variability of its fundamental parameters (bulk density, porosity, uniaxial compressive strength, ultrasonic velocity), related to a marked macroscopical variability of the textural parameters: on the basis of textural parameters, five litostratigraphic horizons were recognised. However, in spite of its good physico-mechanical features, related to welding processes and post-depositional authigenic feldspatization, Piperno used as ornamental stone is affected by weathering processes affecting both scoriae (alveolization) and the ashy matrix (disaggregation and salt crystallization). The present investigation also brought to rediscover the main exploitation site, located at the foot of the western side of the Camaldoli hill, in Naples. The underground quarry covers an area of about 5000 m2. As a whole, its development does not show any predefined exploitation scheme as well as any preferential direction. The quarry is partially filled with reworked materials of undefined thickness, flowing in from the main entrance or from open fractures, and by blocks of many cubic meters falling from the vaults or from the pillars. The planimetric scheme of the hypogeum leads to hypothesize that the exploitation activities were carried out without any particular attention to the stability conditions of the underground site. The location of the pillars, their shape and distance are irregular and their surface does not exceeds 14% of the exploited area, thus confirming the reduced margin of safety. The exploration of the underground quarry, along with the study of its geological and geomechanical features, is the premise for a full appreciation of the old exploitation site, to propose to local authorities in charge of the environmental and architectural heritage of the Neapolitan territory.