pressure shadows, kinking of the phyllosilicates, and mechanical reorientation of the mineral components along s_1. Preferred orientation of the phyllosilicates and slaty cleavage (s_1) have developed, and represent one of the most pronounced structures along which the rock prefers to split. It was shown that in all cases a good correlation exists between the average point load strength index of the rock samples, the direction of loading, and the petrographic/fabric type in the samples without pre-failed surfaces. Failures in the slate and metasiltstone follow concentrations of preferred oriented phyllosilicates of the s_1 slaty cleavage in the first place. Other parameters (e.g. average grain size, granoblastic texture, quantity of quartz etc.) are of secondary importance and find principal expression in homogeneous rocks and in cases when they were loaded transversely to the main discontinuity. In the pre-failed rocks, the direction of loading played the major role. The relevance of the above stated facts is clearly manifested in the field of geotechnical works where their disregard led to landslides on the surface and to several mass collapses in tunnel works. The predominant direction of failure in-situ additionally depends on the geological macrostructure, and on the direction of intervention into the rock. Determination of the fabric and compositional properties of such rocks is a key factor for the identification of the weakest directions and for the appropriate and timely adaption of method and direction of excavation.

Mineralogical and microstructure characterization of a Neogene natural building limestone from Western Crete, Greece

Triantafyllou G.[1], Přikryl R.[2], Repouskou E.[1] and Markopoulos Th.[1]

[1]Department of Mineral Resources Engineering, Laboratory of Petrology & Economic Geology, Technical University of Crete, 73 100, Chania, Greece, gtriant@mred.tuc.gr, repusku@mred.tuc.gr, markpopou@mred.tuc.gr

[2]Institute of Geochemistry, Mineralogy and Mineral Resources, Faculty of Science, Charles University in Prague, Albertov 6, 128 43 Prague 2, Czech Republic, prikryl@natur.cuni.cz

Natural building stones are being used in Crete for ages to build masonry structures because of being abundant, relatively easy to cut and shape and good performance in many applications. In Crete the largest comprehensive occurrences of Neogene sediments are found along the north-western coast (provinces of Chania and Rethymon), in the Heraklion depression and in the Sitia district, Eastern Crete. Several quarries for the extraction of Neogene limestone, being used as building and decorative natural stone, are located in Western Crete country. Despite their great variety, relatively few types of stone are suitable for construction materials. In addition to accessibility and ease of quarrying, the stone must satisfy requirements of strength, hardens, porosity, durability and appearance. Mineralogy and microstructure greatly influences engineering properties lime permeability, strength and durability. The present study summarizes the results of a primary investigation of a Neogene fossiliferous fluvio - lacustrine - brackish - shallow marine marly limestone, cropping out thirty km east of Chania, Crete. The combination of macroscopic rock description, mineralogical, chemical and microstructure analyses were used, in order to characterize the natural stones regarding their colour, lithology, microfacies, sedimentary structure and fabric.

The natural stone is macroscopically described as an unweathered white-yellow to white-grey homogenous compact limestone rock. The mineral composition was investigated by using X-ray diffraction (XRD) analysis. The main minerals present are calcite and quartz, whereas clays, micas and feldspars are present in minor amounts. The chemical composition was determined by wet chemical analyses. The results, illustrate that the composition of the major elements is in general monotonous with typical high contents of CaO (40 % wt.) and SiO_2 (17% wt.), followed by Al_2O_3 (5% wt.). In order to enhance the microscopic analysis of the rock fabric and to observe weathering phenomena, special treatment of the raw samples has been used before the preparation of thin sections. This consists of pore and microcrack staining by a mixture of epoxy resin and fluorescent dye. The prepared thin sections where then observed through a conventional optical microscope (Leica DMLP type), equipped also with a source of UV light. Microscopic investigations showed that, the Neogene formation consists of fossiliferous micrite marly limestones, which appear as moderately-sorted, fine

grained packstones, rich in foraminifera, echinoderms, calcareous as well as siliceous sponge spicules and other bioclasts. Some quartz crystals are well observed. Cavities and chambers in some fossils are filled with relatively coarse-grained mosaics of authigenic sparry calcite. Fabric-selective porosity is controlled by primary depositional fabrics that include interparticle and intraparticle pores. A system of secondary pores, developed independently of texture or fabric (channel porosity) is also observed.

Detailed porosimetric analysis has been conducted using mercury intrusion technique. Through this measurement, pore radii, pore size distribution, pore volume and pore surface area can be evaluated. Porosity in all studied samples is high (29-30 vol. %), the specific surface area of meso-macro-and coarse pores (range of measured pore radii where from 3 nm to 58 μm) varies between 14.04-14.17 m^2/g and the volume of all pore size categories ranges from 160.71-163.43 mm^3/g. Also values of specific surface area and volume of mesopores (2-50 nm), macropores (50-7.500 nm) and coarse pores (over 7.500 nm) where measured respectively. Mineralogy, chemistry, thin section criteria, together with porosity and microstructure characterization, allow these natural building limestones to be used as compatible replacement materials in reconstruction works of certain buildings (monumental and other), that have been previously built with similar natural stones.

Early Pliocene deposits in Kephallonia (Ionian Islands): Biostratigraphy and paleoenvironmental-paleoclimatic implications

Triantaphyllou M.V., Dimiza M.D. and Papanikolaou M.D.

University of Athens, Faculty of Geology & Geoenvironment, Panepistimiopolis 15784, Athens, Greece

The island of Kephallonia is located in the eastern part of the Ionian Sea, off the shores of Western continental Greece. The Paxos geotectonic unit comprises the largest part of the island, while in the eastern part outcrop the Ionian unit sediments. The studied marly limestones and marls in Livadi (approx. 30 m thick) are located on the northeastern part of Paliki peninsula, north of the city of Lixouri. Katelios section (approx. 70 m thick) located at the southeastern coast of the island, consists of marls alternating with sandy layers and marly limestones. The exposed sediments at Livadi represent part of the latest synorogenic deposits of Paxos unit, corresponding to the Trubi limestones above the Messinian evaporites. Katelios sequence is located immediately below the Ionian thrust on Kephallonia Island and could comprise the continuation of the Livadi sequence. Micropaleontologicala analyses (calcareous nannofossils, dinoflagellates and foraminifera) have been performed on both studied outcrops in order to determine their age and investigate the paleoenvironmental and paleoclimatic depositional conditions.

Calcareous nannofossil biostratigraphy revealed a number of biovents establishing the chronostratigraphic correlations of the studied deposits. In the sediments of Livadi section, the presence of *Sphenolithus* spp. (abundance >5%), several discoasterid species (*Discoaster brouweri, D. pentaradiatus, D. surculus, D. intercalaris, D. variabilis*) and abundant planktonic foraminiferal species *Sphaeroidinellopsis* spp. along with the moderate presence of *Amaurolithus* spp. and *Reticulofenestra pseudoumbilicus* (abundance 1-2%) documents the biostratigraphic correlation with the nannofossil biozone NN12. Livadi outcrops are more precisely assigned within the *Sphaeroidinellopsis* Acme Zone, just below the Paracme Zone of *R. pseudoumbilicus*. Therefore they are of Early Zanclean age, ranging between 5.30-5.21 Ma. The sequence of Katelios section is featured by the dominance of *R. pseudoumbilicus* (abundance >20%), the presence of *Pseudoemiliania lacunosa* and *Discoaster asymmetricus, D. pentaradiatus, D. surculus*, that enable the biostratigraphic assignment within the NN14-15 nannofossil biozone (4.12-3.839 Ma) during the Late Zanclean.

The dynamics of calcareous planktonic and benthic communities are of paramount significance in estimating the palaeoenvironmental conditions because they quickly respond to oceanographic changes (primary production, water stratification, temperature, salinity, etc.).

Warm surface water conditions in a pelagic environment are assumed for the interval just above the Miocene-Pliocene boundary (uppermost synorogenic sediments of Paxos unit,