Tectonic deformation and hydrogeological pattern in fissured rocks and karstic systems. Examples from the Pelion Mt and Mani peninsula, Greece

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Tectonic deformation exerts a significant role in the hydrogeological pattern, because water flow either follows or is severely influenced by the tectonic structures of all scales. Two examples are displayed: one in a fissured rocks media (Eastern Pelion) and another one in a karstic system (Mani peninsula).

In the area of Pelion, schists and gneisses are considered of low permeability and negligible primary porosity, nevertheless water recharge and percolation occurs mainly through fractures. The hydrogeological pattern is highly controlled by the tectonic deformation both in the Micro-Mesoscopic (fracturing within the schist) as well as the Macroscopic scale (several km long faults where the springs are aligned). Subsurface flow occurs towards the northeast following the eastern limb of the Pelion mega-anticline, the topographic inclination, the direction of foliation and a major set of faults at this azimouth. Springs are aligned to the faults and three dominant sets of faults are observed. Two of them are NE-SW trending (N $030^{o} \pm 10^{o}$ and N $050^{o} \pm 10^{o}$), forming a 20^{o} angle of tectonic wedge, whereas the third set is NW-SE trending (N $320^{o} \pm 5^{o}$).

In the case study of Mani the karstic path is highly related to the tectonic structures and in particular:

a) towards the mountain area it follows the anticline megastructures with a NNW-SSE trending fold axis that are plunging towards south;

b) towards the hilly area and the lower slopes it strikes west following the transverse fault structures that form oblique normal faults that are E-W trending;

c) towards the lowland, shoreline and offshore area the karstic water produces gushing springs along strike the NNW-SSE trending normal faults that were formed during the recent extensional field and predominantly towards their intersection points with the transverse E-W trending oblique normal faults.

However, the impact of the tectonic deformation is different within these two systems. In the karstic system major structures predominantly control the water flow which is characterized by high velocities. Water flow involves major localized pathways that are elongated with high seasonal variations in discharge rates. In fissured rocks the microscopic scale plays the predominant role in infiltration and flow processes, whereas the macroscopic structures control mainly the spring's distribution and the localities where the hydraulic head of the aquifer intersects the surface and springs discharge. In fissured rocks, based on our estimates the maximum depth where water penetrates does not exceed 300m and water flow is characterized by slower velocities, involving a time delay mechanism. Finally, several minor and widespread pathways are formed, so that the thickness and the overall pattern of the heterogeneous aquifer changes spatially over short distances not only due to lithology, but predominantly due to the tectonic deformation.

Foraminiferal biofacies analysis and paleoecological data on Upper Cretaceous sediments of the Gagra-Java zone (Western Georgia)

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The paper deals with actual questions concerning biofacies and paleoecology of the Gagra-Java zone. The Gagra-Java zone extends along the Southern slope of the Greater Caucasus, in its turn subdivided into three facies types: Abkhazia-Racha, Odishi-Okriba and Dzirula. The Cretaceous sediments have developed mainly in the junction area of the

Georgian block, from the Western Georgia up to Upper Racha. The Upper Cretaceous sediments consist predominantly of terrigenous-volcanogenic (Cenomanian-Lower Turonian) and marly carbonate limestones with the layers of variegated flints (Upper Turonian-Maastrichtian). According to planktonic and benthic foraminifera in the Abkhazia-Racha sediments have been distinguished 14 foraminifera complexes. The detailed analyses have proved that: 1. The lower boundary of the Upper Turonian is connected to the massive occurrence of the genera *Marginotruncana pseudolinneiana-M. schneegansi-M. lapparenti;* 2. The Turonian/Coniacian boundary is based on the occurrence of *Marginotruncana coronata* Bolli; 3. The Coniacian/Santonian boundary - *Dicarinella concavata* (Brotzen); 4. The lower boundary of the Upper Santonian is based on the appearance of *Contusotruncana (Rosita)* fornicata (Plummer); 5. The Santonian/Campanian boundary is based on the presence of *Globotruncana arca* (Cushman); 6. The Campanian/Maastrichtian boundary, based on the occurrence of *Globotruncanita stuarti* (Lapparent). In the Odishi-Okriba facies type has been distinguished the suite "mtavari", investigated in detail by planktonic foraminifers. The analyses made possible to establish 5 foraminiferal zones in the studied sections. These complexes have been correlated with macrofauna and nannoplankton complexes to specify the age of the suite. At present, there exists a definite methodology for the reconstruction of some parameters of the paleobasin that is based on quantitative interrelations of foraminifer associations. This technique is based on actual data of contemporary water areas. The PF (Planktonic Foraminifer) data can be used for the interpretation of the fossil material data applicable in paleogeographic reconstructions. The relation of planktonic and benthic foraminifera and the content of planktonic complex enable to define depth of the basin. According to the percentage of the left- and right-coiling species of Globotruncanidae, there have been estimated the temperature conditions of the Late Cetaceous basin. The question on the parity of left- and right-coiling foraminifera is a part of big problem of coiling directions in the nature.

Gemstone deposits of Lece volcanic complex (South Serbia)

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Gem raw materials do not have a long tradition in Serbia, neither concerning their geological exploration nor their utilization. Nevertheless, few relatively modest exploration campaigns discovered number of gemstone deposits and occurrences grouped into several regions. One of the most important regions is Lece volcanic complex which is situated in the southern part of Serbia and covers an area which exceeds 700 km². This volcanic complex, formed as a result of Tertiary volcanic (intermediate) activity, is a part of Serbo-Macedonian metalogenic province, i.e. Lece–Chalkidiki metalogenic zone. It comprises mostly andesite rocks and their pyroclastic equivalents.

Gemstone deposits of Lece volcanic complex became the subject of interest after the World War II, although on the basis of certain archeological finds, we can assume that the Ancient Romans beside gold exploited amethyst and agate as well. The first modern explorations were carried out during 1970`s and at the beginning of 1980`s, when several deposits with calculated reserves were defined. The exploration was continued in 2002 and 2003. Laboratory analyses – at first micropetrographic, were followed by chemical and gemological (refractive index). Apart from the above mentioned investigations, in order to establish whether silica minerals have real gem quality gemstone processing (lapidary) was conducted.

This paper deals with explored deposits (having reported reserves according to Serbian laws). There are two basic types of deposits: primary (hydrothermal) and secondary (sedimentary).

Rasovača deposit. Precious minerals in this deposit occur in the same fracture zone together with metallic ore mineralization of Pb, Zn, Ag and Au (Lece underground mine). It is a quartz-brecciated fracture zone, with hydrothermal (epithermal) mineralization, a few