Gamma rey spectrometry analysis of pre-Neogene basement rocks and its Implications on the radiogenic heat generation potential

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sols, and one of the best examples can be found at Zlatni rt locality in Rovinj.

The palaeosol marks the contact between Muča and Kirmenjak units. The Muča unit consists of two lithofacies (LF) types, representing high to moderate energy marine environments: LF 1 – bioclastic-peloidal grainstone to rudstone characterized by common to abundant peloids and benthic foraminifera, rare ooids, algae, fragments of echinoderms, hydrozoans, coated fragments of *Cladocoropsis*, stromatoporids, bivalves, Rivulariacean-like (*Cayeuxia*) cyanobacteria, corals and *Lithocodium*; and LF 2 – bioclastic-peloidal packstone with common to abundant peloids, benthic foraminifera and fragments of echinoderms. The beginning of regression was marked by Rovinj breccias, which form lenses atop of Muča unit. The palaeosol forms a decimetre-thick horizon of grey clay, which is also present as infills in karstified channels and fissures of the Muča unit and Rovinj breccia. Among other minerals, the palaeosol contains glauconite that formed during the incipient flooding of the carbonate terrain. As the transgression progressed, the palaeosol was covered by a decimeter-thick layer of transgressive breccia, containing fragments of Muča unit and upper Tithonian black pebbles. The formation of black pebbles under vadose conditions is evidenced by the presence of *Microcodium*-like structure, alveolar-septal fabric (in voids of fenestral origin?) and other features indicating subaerial exposure. In the area of Zlatni rt the Kirmenjak unit, which covers the palaeosol and the breccia, begins with a bioclastic (algal)-peloidal grainstone to rudstone abundant in bioclasts of *Campbelliella striata*, *Clypeina sulcata*, *Salpingoporella annulata* and *Favreina* faecal pellets. The rest of the Kirmenjak unit is composed of a cyclic alternation of mudstones, peloidal to bioclastic packstones to grainstones and black pebble breccias with subaerial exposure surfaces.

A very well preserved palaeosol level at the Zlatni rt locality documents one of unique terrestrial palaeoenvironments that existed during the early Kimmeridgian to late Tithonian in the northern part of the Adriatic Carbonate platform.

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GAMMA REY SPECTROMETRY ANALYSIS OF PRE-NEOGENE BASEMENT ROCKS AND ITS IMPLICATIONS ON THE RADIOGENIC HEAT GENERATION POTENTIAL

ANALIZA REZULTATA POVRŠINSKE GAMMA SPEKTROMETRIJE NA STIJENAMA PODLOGE NEOGENA I UTJECAJ NA MOGUĆNOST GENERIRANJA RADIOGENE TOPLINE

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Temperature distribution in the subsurface depends on several factors, including regional heat flow, thermal conductivity of rocks, their radiogenic potential, and local factors that can lead to higher temperatures at shallower depths, such as active migration pathways. In this work, the potential for thermogenic heat generation in the pre-Neogene basement rocks was investigated based on their content of uranium, thorium, and potassium (ABDEL HAFEEZ *et al.*, 2019; ADABANIJA *et al.*, 2020; SANJURJO-SÁNCHEZ *et al.*, 2022). For this purpose, a Gamma Surveyor Vario field gamma-ray spectrometer (Fig. 1) was used to measure the concentrations of the above elements at outcrops on the margins of the Drava sub-basin.

At least three measurements were made at each outcrop, which were later averaged. In total, more than one hundred observation points were measured. The general lithology was summarized in six categories (Table 1): Triassic dolomites, effusive rocks (basalt), granitoid, schist, gneiss, and Miocene effusive rocks. In most cases, the measurements yielded higher values for radioelements than the catalogue values in the Schlumberger PetroMod lithology editor (SCHLUMBERGER PETROMOD, 2022), suggesting a higher potential for radiogenic heat generation. This is a crucial parameter in basin modelling that will help to better estimate the geoenergy potential of the subsurface in the eastern part of the Drava sub-basin.

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Figure 1. Field measurements with gamma Surveyor Vario

Table 1. Uranium, thorium and potassium values in reference to their radiogenic heat potential

	Dolomite Triassic				Effusive (Basalt)				Andesite Miocene			
Lithology	typical		local		typical		local		typical		local	
U [ppm]	0.8		2.65		0.9		1.42		1.35		11.78	
Th [ppm]	0.6		2.15		2.7		3.51		2.5		24.82	
K [%]	0.4		0.51		0.8		1.01		1.4		4.13	
Porosity [%]	0	10	0	10	0	10	0	10	0	10	0	10
Bulk Value [μW/m³]	0.29	0.26	0.91	0.82	0.52	0.47	0.75	0.67	0.64	0.58	5.04	4.53
	Granitoide				**Schist PNg**				**Gneiss PNg**			
Lithology	typical		local		typical		local		typical		local	
U [ppm]	6.5		4.63		2.1		3.53		5		5.73	
Th [ppm]	17		13.3		9.7		10.33		13		13.67	
K [%]	5.7		4.23		2.2		2.9		3		4.39	
Porosity [%]	0	10	0	10	0	10	0	10	0	10	0	10
Bulk Value [μW/m³]	3.32	2.99	2.46	2.21	1.44	1.29	1.92	1.73	2.5	2.25	2.87	2.58

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