

Oligocene tuffs at Domžale, the Ljubljana basin, Slovenia

Oligocenski tufi pri Domžalah

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Abstract

Oligocene volcanics have not been found yet in the Ljubljana basin. At Domžale, fine-grained tuffs predominate, although coarse-grained and lapilli tuffs also occur. The main constituents are volcanic glass shards. The tuffs are rhyolitic in composition. Alteration is reflected in the development of clay minerals - calcic montmorillonite and illite.

Kratka vsebina

V Ljubljanski kotlini do sedaj še nismo našli predornin oligocenske starosti. Pri Domžalah prevladujejo drobnozrnati tufi, med njimi pa se pojavljajo tudi debeložrnati in lapilni tufi. Glavna sestavina tufov so črepinjice vulkanskega stekla. Sestava tufov je riolitna. Spremembe se odražajo predvsem v kristalizaciji glinenih mineralov - kalcij-skega montmorillonita in illita.

Introduction

Untill the present, Oligocene volcanics were not known in the Ljubljana basin. They are abundantly encountered in the Celje basin and in the Smrekovec volcanic complex in northern Slovenia. They also occur in the Velenje and the Laško basins, in the Rogatec and the Zasavje areas, and in the surroundings of Radovljica in north-western Slovenia. Explosive volcanism predominated in the late-stage of volcanic activity, when magmas became more acid in composition. In the Celje and the Laško basins, pyroclastic deposits of dacitic composition predominate.

Domžale are located about 10 km north-east of Ljubljana (Fig. 1). In the area,

Quaternary clays and clayey gravels with abundant organic matter predominate (Premru, 1978). Upper Triassic - Liassic and Cretaceous carbonate rocks outcrop east and south of Domžale. Along their margins, Oligocene clastics are encountered. They are developed as basal conglomerates, sandstones, siltstones and claystones. Oligocene tuffs occur northeast of Domžale, at the contact with Mesozoic carbonates. Fresh rocks were exposed during the construction of the Ljubljana - Lukovica highway.

In this paper, petrology and chemical composition of Oligocene tuffs from Domžale are described. The tuffs are compared with similar tuffs occurring in the Celje and the Laško basins, and in the Radovljica area.

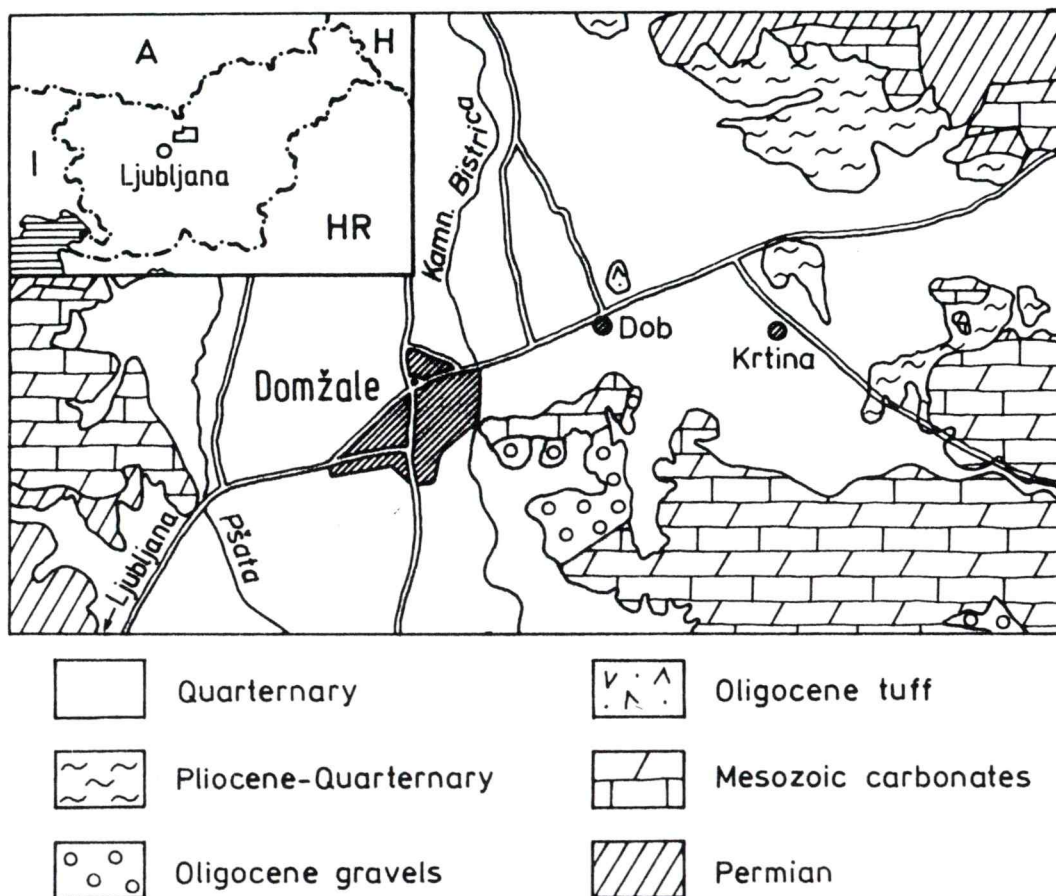


Fig. 1: Simplified geological map of the Domžale area (modified after Premru, 1978)

Sl. 1: Poenostavljena geološka karta okolice Domžal (prirejeno po Premruju, 1978)

Petrology and chemical composition of tuffs

The main constituent of tuffs is matrix, composed of volcanic glass shards. Crystal grains are less abundant and consist of twinned plagioclases having albite to oligoclase composition, and alkali feldspars; femic minerals, probably biotite, are thoroughly altered to iron oxides.

Volcanic glass is extensively altered to microcrystalline quartz and filosilicates - chlorite, illite and calcic montmorillonite. Many plagioclases are albitised. Perfectly round concretions of iron oxides and quartz occur having 0,5 - 2 cm in diameter.

The tuff has rhyolitic composition (Table 1). Silica content amounts to 73,3 wt.%,

calculated on anhydrous basis, it amounts to 76,8 %. Sodium is very low - 0,45 wt.% and seems to be depleted owing to the rock alteration. The water content is relatively high and is related to the formation of clay minerals. Potassium amounts to 4,79 wt.%, which is higher than for dacitic tuffs from Trobni Dol, Zaloška Gorica or Sveti Rok at Rogaška Slatina.

Conclusions

New findings of Oligocene tuffs outcropping at Domžale, northeast of Ljubljana indicate, that they are rhyolitic in composition and consist of altered volcanic glass shards and plagioclase and alkali feldspar

Table 1: Chemical composition of tuff from Domžale

Preglednica 1: Kemična sestava tufa iz Domžal

Major oxides wt. %	Sample AC-G/5	Trace elements (ppm)	Sample AC-G/5
SiO ₂	73,7	Li	36
TiO ₂	0,194	Be	1,4
Al ₂ O ₃	12,1	B	<10
Fe ₂ O ₃	1,20	Sc	3,1
MnO	<0,01	V	16
MgO	0,76	Co	13
CaO	1,73	Ni	4
Na ₂ O	0,45	Cu	5,6
K ₂ O	4,79	Zn	23,7
L.O.I.	4,80	Ge	<10
Sum.	99,5	Sr	377
		Mo	<1
		Ag	0,4
		Pb	<2
		Rb	176
		Zr	149
		Nb	11
		Ba	865
		S	0,03
		Cl	78
		Hg	22
		Ga	11
		Y	19
		Cd	0,3
		In	<0,5
		La	43,7
		Ce	72,3
		Pr	7,5
		Nd	30,5
		Sm	5,2
		Eu	1,29
		Gd	4,8
		Tb	0,8
		Dy	4,6
		Ho	0,89
		Er	2,7
		Tm	0,4
		Yb	2,7
		Lu	0,40
		Tl	0,7
		Bi	<0,5
		Au	3
		Cr	8
		As	3
		Se	<5
		Br	<1
		Sb	0,3
		Cs	5
		Hf	3
		Ta	4
		W	69
		Th	15,3
		U	4,6

grains. They are relatively rich in potassium and low in sodium. Sodium was possibly leached from the rock during alteration involving the formation of clay minerals. The tuff deposits in the Celje (Krošl - Kuščer, 1985) and the Laško basins (Kralj, 1998), at Sveti Rok in the Rogaška Slatina area and in northwestern Slovenia at Peračica, are very similar to the occurrences at Domžale, except for bearing zeolites. This is probably the reason for very low sodium content in the tuffs from Domžale, as sodium incorporated in the zeolite lattice can not be leached so easily as sodium, adsorbed on the surfaces of clay minerals. In spite of different alteration pattern, the tuffs from Domžale belong to somewhat more acid - rhyolitic volcanics than the tuffs from the Celje and the Laško basins, and Sveti Rok at Rogaška Slatina.

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