GEOLOŠKI VJESNIK	44	151 - 159	2 Pl.	5 Figs.		ZAGREB 1991

AN OCCURRENCE OF BADENIAN RHYOLITIC VOLCANOCLASTIC ROCKS FROM MIDDLE PARTS OF MT. DILJ (EASTERN CROATIA)

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Key words: Badenian, bioclastic limestone, volcanism, alkali-feldspar, rhyolite, rhyolitic tuff.

Ključne riječi: baden, bioklastični vapnenac, vulkanizam, alkalijsko-feldspatski riolit, riolitni tuf.

A polyphase volcanism which took place during the Badenian in the area of the present Mt. Dilj as well as in surrounding Slavonija had given rise to changes in palaeoecological environment and thus essentially controlled the growth of biolithite bodies. During the comparatively calm interval of sedimentation, carbonate rocks with corals as reef-forming elements under very favourable environment were deposited. By contrast, the growth of reefs is ceased by intermittent volcanic phases which give rise to the influx of pyroclastic material.

A bed of slightly consolidated monomictic gravel in the lower parts of the lithostratigraphic column Zdenci has been studied in detail. All of analysed fragments of gravel and insoluble residiuum of bioclastic limestone have rhyolitic composition. Rhyolitic varietes as follows have been determined: crystallovitrophyric and vitrocrystal rhyolitic tuff, spherulitic rhyolite, aphyric alkali-feldspar rhyolite and slightly porphyritic alkali-feldspar rhyolite.

Polifazni vulkanizam koji je djelovao tijekom badena na području današnje Dilj gore, kontrolirao je promjene paleoekoloških uvjeta i time utjecao na rast biolitnih tijela. Za vrijeme mirnih razdoblja talože se karbonatne stijene sa crvenim algama i/ili koraljima kao grebenotvorcima, dok vulkanske erupcije imaju za posljedicu veći donos vulkano-klastičnog materijala i time zaustavljaju rast grebena.

Detaljno je izučavan sloj slabo vezanog monomiktnog šljunka u donjem dijelu litostratigrafskog stupa Zdenci. Sve obrađene valutice, kao i netopivi ostatak bioklastičnog vapnenca imaju riolitni sastav. Izdvojeni su slijedeći riolitni varijeteti: kristalovitrofirni i vitrokristalni riolitni tuf, sferulitski riolit, afirni alkalijsko-feldspatski riolit i slaboporfirni alkalijsko-feldspatski riolit.

1. INTRODUCTION

A lithostratigraphic cross-section exposed in the quarry in the neighbourhood of Zdenci and located in the middle parts of Mt. Dilj has been studied in detail (Figs. 1 and 2). The cross-section is made up of Badenian, Sarmatian s. str. and Lower Pannonian sediments. Because the data on the cross-section have been already published (ŠPARICA et al., 1988), only the succession of Badenian rocks will be briefly presented.

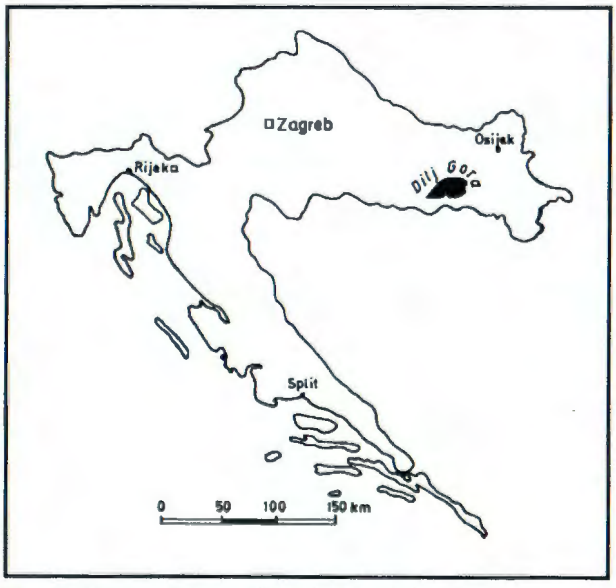

Fig. 1 The position of Dilj Mountain
Slika 1 Položaj Dilj Gore

Badenian is represented mostly by carbonate rocks. Lower parts of the Badenian consists of varieties of limestones: biosparrudite and very sandy biosparite. Bioclasts are represented by fragments of reddish algas, bryozoas, echinodermata plates and spicules, molluscs and forams. The limestones contain subordinate quantities of volcanoclastic fragments as well.

Limestone are overlain by a bed of monomicte gravel which consists exclusively of rhyolitic pebbles and limy sand. The gravel is poorly cemented and unsorted; well rounded pebbles are up to 5 cm in diametre. Gravel displays a weakly preserved cross-bedding and the sediment was probably deposited in a tidal channel.

Gravel is overlain by bioclastic limestones with isolated fragments of volcanoclastic material. The limestones grade into a coral bioherm in which volcanoclastic rocks were not found. The bioherm is covered with a bed of bioclastic limestones about 2,5 m thick which contains gravel and sandy admixtures and the increased quantity of volcanoclastic fragments up to 3 cm in the size.

Uppermost parts of the Badenian are made up of algal limestones with scarce dissiminated volcanoclastic material which are overlain by algal biomicrorudites.

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2. PETROGRAPHY OF THE VOLCANOCLASTIC BED

Megascopically, whiteish bioclastic limestone, containing scarce, single commonly psammitic and rarely pelitic fragments of volcanic rocks, grades into strongly conglomeratic and sandy bioclastic limestone. By the increasing quantity of psefitic and psammitic volcanic fragments, the limestones grade into brecciated sandstones.

Fragment 0.5 to 2 mm in size (Plate I, Fig. 1) are of rhyolitic composition; they are mostly subrounded. The intersticies are filled with small subrounded fragments of the same rocks and quartz and feldspar grains; complete foraminiferas and fragments of reddish algas are scarce. The detrital grains are weakly sorted and cemented by sparry calcite. The rock is strongly sandy biosparite, partially volcanic arenite. Insoluble residuum (treated by dil. HCl) of the rock has a rhyolitic chemical composition (Table 1, an. 6). Its mineral composition, obtained by X-ray diffraction, is characterized by predominant quartz with K-feldspar and albite and subordinate illite and kaolinite.Strongly conglomeratic and sandy bioclastic limestone grades into a bed of a weakly cemented monomict gravel. All examined pebbles have rhyolitic chemical composition; the following varieties of rhyolites can be distinguished: crystallovitrophyric rhyolitic tuff, vitrocrystalline rhyolitic tuff, spherulitic rhyolite, aphyric alkali-feldspar rhyolite and weakly porphyritic alkali-feldspar rhyolite.

Crystallovitrophyric rhyolitic tuff, vitrocrystalline rhyolitic tuffs (Plate I, Figs. 2 and 3) make up the most part of pebbles of the bed. The tuff is poorly psammitic in texture and homogeneous in structure. Subordinate detrital grains of alkali-feldspar and very scarce quartz are embedded in groundmass, which is mostly vitric. The size od detrital grains is 0.2 to 0.5 mm. Glass from the groundmass of vitrocrystalline tuff is mainly recrystallized into a very fine - crystalline aggregate consisting of alkali-feldspar and quartz which contain minute inclusions of chlorite, sericite and opaque mineral(s). Intersticies are filled by fine-grained sericite and chlorite aggregates. Some tuff pebbles contain secondary nests filled by secretional quartz with subordinate chlorite.

Spherulitic alkali-feldspar rhyolite (Plate II, Fig. 3) is spherulitic in structure with poorly preserved perlitic texture. Radially arranged microlites of alkali-feldspar and quartz make up the spherulites about 0.3 mm in diametre, whose nucleus consists commonly of chalcedony with the size of grains about 0.1 mm. Intersticies of spherulites are built up of glass partially recrystallized into sericite and chlorite. Accessory constituent is an xenomorphic opaque mineral (s).

Aphyric alkali-feldspar rhyolite (Plate II, Fig. 2) is a variety with holocrystalline fine-grained texture and homogeneous structure. Mineral grains, about 0.2 mm in the size, are xenomorphic to hypautomorphic and

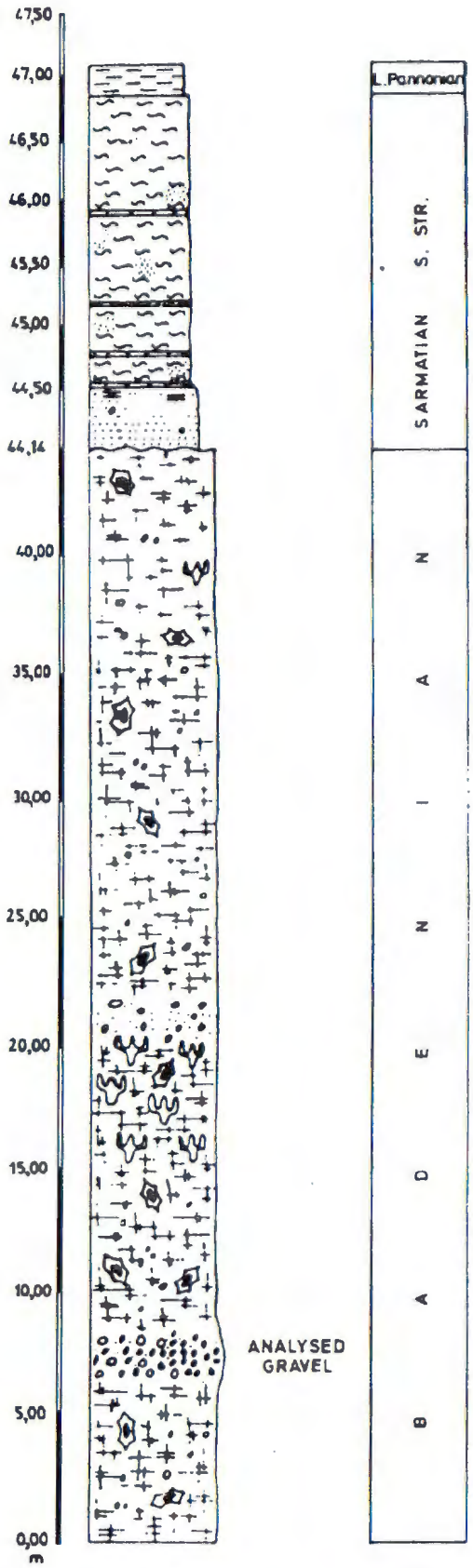

Fig. 2 The position of volcanoclastics in the lithostratigraphic column (from ŠPARICA et al., 1988).
Slika 2 Položaj vulkanoklastita u litostratigrafskom stupu (prema ŠPARICA et al., 1988).

they display irregular or subophitic arrangment. Mineral assemblage includes predominant quartz and alkali-feldspar, secondary chlorite and sericite, and accessory opaque mineral(s).

Slightly porphyritic alkali-feldspar rhyolite (Plate II, Fig. 1) is a variety with semicrystalline texture and homogeneous structure. Scarce alkali-feldspar phenocrysts, up to 1.5 mm in size, are embedded a glassy groundmass which is partly recrystallized. Based on chemical and normative composition, the predominant groundmass consists of quartz, albite and K-feldspar. Some parts of the groundmass are mostly glassy and isotropic with very fine-grained aggregates of chlorite and/or celadonite. Minute and irregular grains of opaque mineral(s) are evenly dissiminated throught the rock.

3. CHEMICAL COMPOSITION OF RHYOLITE VITROCALASTIC ROCKS

The chemical composition with data of the petrochemical calculations are presented in Table 1. The analyses 1, 2 and 5 illustrate the composition of rhyolitic tuffs, the analysis 3 of spherulitic rhyolite, the analysis 4 of slightly porphyrtic alkali-feldspar rhyolite whereas the analysis 6 shows the composition of the insoluble residuum of conglomeratic and sandy biosparite.

All these rocks, including insoluble residuum, are characterized by very high SiO_2 content (71 to 76%), which is a characteristic of high-silica rhyolites (HILDERETH, 1981). These rocks contain low quantities of CaO and femic components and high quantities of alkalies, commonly with K_2O predominant over Na_2O. The presented Na_2O+K_2O versus SiO_2 diagram (Fig. 3A) proposed by MIYASHIRO (1978) demonstrates that the points fall partly in the field of rocks of the alkali volcanic series and partly near the boundary area of rocks of the subalkali series.

The Qz-Or-Ab triangle (Fig. 3B) displays the scattering of points due to unequal proportions of normative orthoclase and albite. On the Na_2O+K_2O-CaO-FeO+MgO triangle (Fig. 3C), all points are gathered in the alkali field except the one which relates to insoluble residuum of limestones which is slightly impured by $CaCO_3$. On the diagram SiO_2 against Na_2O+K_2O (Fig. 4) proposed by LE BAS et al., (1986), all points fall in the rhyolitic field. The triangle diagram Q-L-M illustrates that all points fall in the leucocratic field oversaturated with quartz (Fig. 5).

It is interesting to note that the calculated Niggli's values do not fit in any of the proposed magma types due to the high k-value (the average is 0.7) and very high si-value (the average is 476).

For the scope of correlation, on all the diagrams are also drawn petrochemical data of albite rhyolites from Mt. Dilj (PAMIĆ & ŠPARICA, 1988) which are marked by full circles.

	1	2	3	4	5	6
SiO_2	75,60	71,32	71,52	73,60	76,75	74,11
TiO_2	0,06	0,02	0,03	0,03	0,02	0,35
Al_2O_3	13,39	13,13	11,42	14,79	11,36	12,59
Fe_2O_3	1,82	1,20	2,73	0,42	2,93	0,39
FeO	0,17	0,19	0,26	0,17	0,18	0,19
MnO	0,01	0,01	0,01	0,01	0,01	0,01
MgO	0,00	0,00	0,01	0,30	0,00	0,30
CaO	0,70	1,40	0,98	0,98	0,62	2,10
Na_2O	0,44	3,40	3,32	1,64	0,92	6,19
K_2O	5,78	4,00	6,68	5,51	5,19	1,15
P_2O_5	0,00	0,00	0,10	0,00	0,00	0,00
H_2O	1,64	5,05	2,46	1,23	1,69	2,29
Σ	99,61	99,72	99,52	99,76	99,75	99,67

Q	49,0	34,0	28,0	36,8	49,0
C	5,2	0,7	—	3,3	3,2
Or	34,9	25,0	40,8	39,0	31,3
Ab	3,8	30,4	22,5	14,1	8,0
An	3,5	7,3	—	4,9	3,1
Ns	—	—	1,5	—	—
DIWO	—	—	1,8	—	—
DIEN	—	—	0,01	—	—
DIFS	—	—	2,1	—	—
HYEN	—	—	0,02	0,80	—
HYFS	3,3	2,4	3,1	1,0	5,3
IL	0,17	0,1	0,06	0,06	0,04
AP	—	—	0,25	—	—
SAL	96,67	97,5	91,2	98,2	94,7
FEMIC	3,4	2,5	8,8	1,8	5,3

Si	529,63	441,46	406,74	448,68	552,39
Al	55,30	47,89	38,84	53,07	48,12
Fm	10,60	6,63	13,06	5,57	16,98
c	5,25	9,28	5,97	6,39	4,77
Alk	28,80	36,19	42,53	34,97	30,11
k	0,00	0,44	0,57	0,72	0,70
Ti	0,08	0,11	—	0,08	0,07
mg	—	—	0,01	0,49	—
si	—	—	0,29	—	—
Qz	196,70	196,69	148,88	208,81	331,94
Q	66,84	58,65	53,86	59,95	67,09
L	26,42	39,16	40,50	35,96	26,69
M	6,74	2,18	5,65	4,09	6,22

TABLICA - TABLE I

Chemical composition, CIPW norms and Niglli values.
Kemijski sastav, normativni sastav i Nigllijeve vrijednosti.

1, 2 and 5 rhyolitic tuff; 3 spherulitic rhyolites; 4 slightly porphyritic alkali-feldspar rhyolites; 6 insoluble residum of the very sandy biosparite.
1, 2 i 5 riolitni tuf; 3 sferulitni riolit; 4 slaboporfirni alkalijsko-feldspatski riolit; 6 netopivi ostatak od jako pjeskovitog biosparita.

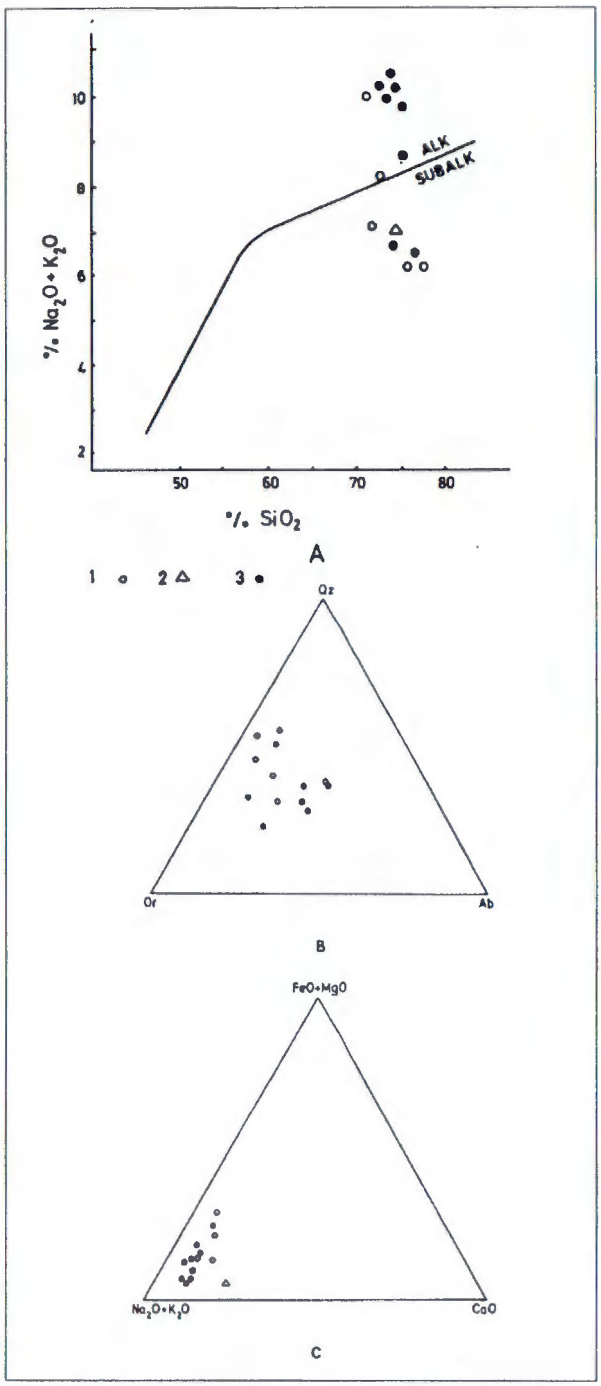

Fig. 3
A. The diagram SiO_2 versus Na_2O+K_2O (Miyashiro, 1978)
B. Triangle diagram Qz-Or-Ab
C. Triangle diagram FeO+MgO-Na_2O+K_2O-CaO
Slika 3
A. Dijagram SiO_2 : Na_2O+K_2O (Miyashiro, 1978)
B. Trokomponentni dijagram: Qz-Or-Ab
C. Trokomponentni dijagram: FeO+MgO-Na_2O+K_2O-CaO
1. rhyolitic volcanoclastic rocks in quarry near Zdenci vulkanoklastične riolitne stijene u kamenolomu kod Zdenaca
2. insoluble residuum of the very sandy biosparite netopivi ostatak jako pjeskovitog biosparita
3. albite rhyolites from Dolovi albitni rioliti iz Dolova

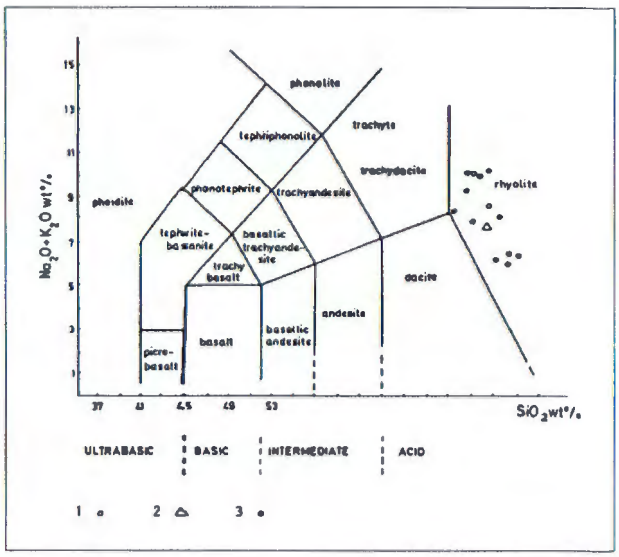

Fig. 4 The total alkali-silica diagram (TAS)(LE BAS et al., 1986)
Slika 4 Dijagram SiO_2 : Na_2O+K_2O (LE BAS et al., 1986)
1. rhyolitic volcanoclastic rocks in quarry near Zdenci vulkanoklastične riolitne stijene u kamenolomu kod Zdenaca
2. insoluble residuum of the very sandy biosparite netopivi ostatak jako pjeskovitog biosparita
3. albite rhyolites from Dolovi albitni rioliti iz Dolova

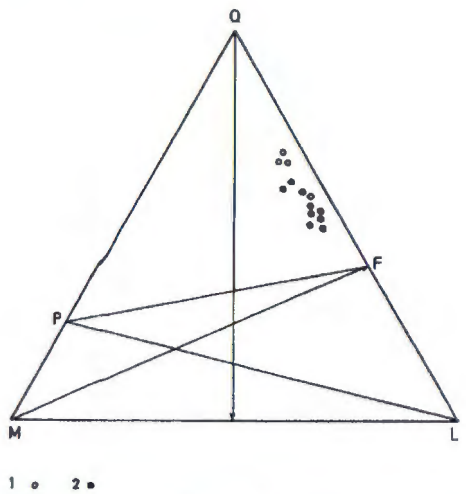

Fig. 5 Triangle diagram Q-M-L
Slika 5 Trokomponentni dijagram Q-M-L
1. rhyolitic volcanoclastic rocks in quarry near Zdenci vulkanoklastične riolitne stijene u kamenolomu kod Zdenaca
2. albite rhyolites from Dolovi albitni rioliti iz Dolova

4. DISCUSSION

Volcanic rocks form Dolovi, about 2 km eastern of Zdenci, were first described by PAMIĆ & ŠPARICA (1988) who came to the conclusion that they were synsedimentary with Badenian marly biomicrites. This volcanic association is represented mostly by albite rhyolite, rhyolitic tuff and quite subordinate metaandesite.

The albite rhyolite and rhyolitic tuff from Mt. Dilj can be positively correlated in structure, texture, mineral, chemical composition, and variations in chemical composition with alkali-feldspar rhyolite volcanoclastic rocks form the Zdenci quarry, as illustrated on the presented diagrams.

Very similar high-silica alkali-feldspar rhyolites occur also in Upper Cretaceous bimodal volcanic aassociation of the neighbouring Požeška Gora (PAMIĆ & ŠPARICA, 1983, PAMIĆ, 1990).

A polyphase volcanism which took place during the Badenian in the area of the present Dilj Gora as well as in the surrounding Slavonija had given rise to changes in paleoecological environment and thus essentially controlled the growth of biolithite bodies. During comparatively calm period of sedimentation, carbonate rocks with reddish algas and biolithite bodies with corals as reef-forming elements under conditions of very favourable environment were deposited. By contrast, the reef growth is ceased by intermittent volcanic phases which had given rise to the influx of pyroclastic ma-terial.

On the basis of correlated data on Badenian submarine volcanic rocks from Dolovi and volcanoclastic rocks from the Zdenci quary, it can be concluded that the biolithite facies from the latter area is contemporaneus with marly biomicrites, probably of lagunar origin, from the area of Dolovi.

We thank dr. Jakob Pamić and dr. Marko Šparica for helpful discussions and suggestions while working on the manuscript.

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POJAVA RIOLITNIH BADENSKIH VULKANOKLASITA U SREDIŠNJEM DIJELU DILJ GORE (ISTOČNA HRVATSKA)

M. Belak, M. Sarkotić Šlat i D. Pavelić

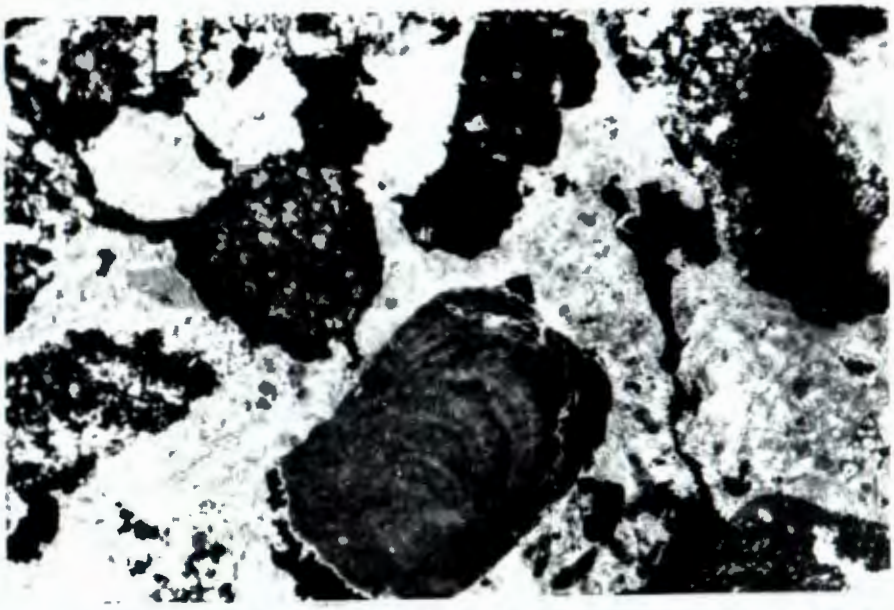
U središnjem dijelu Dilj gore u kamenolomu kod naselja Zdenci, ranije je detaljno snimljen litostratigrafski stup koji je obuhvatio sedimente badena, sarmata s.str. i donjeg panona (ŠPARICA et al., 1988). Unutar badena, koji je izgrađen uglavnom od karbonatnih stijena, dolazi povećani sadržaj vulkanoklastičnog detritusa; vapnenac prelazi u jako konglomeratično-pjeskovitu karbonatnu stijenu, na kojoj leži sloj slabo vezanog monomiktnog šljunka, izgrađenog isključivo od valutica riolitnog sastava te karbonatnog pijeska kao matriksa. Sve obrađene valutice kao i netopivi ostatak bioklastičnog vapnenca (otapanje vapnenca u dil. HCl) imaju riolitni sastav. Kristalovitrofirni i vitrokristalni riolitni tuf su najučestaliji vulkanski fragmenti, a kao podređeni varijeteti dolaze: sferulitski riolit, afirni alkalijsko - feldspatski riolit i slaboporfirni alkalijsko - feldspatski riolit.

Utvrđen je slijedeći mineralni sastav navedenih riolitnih varijeteta: ortoklas, albit, kvarc, klorit, sericit i magnetit. Modalni mineralni sastav se razlikuje za pojedine varijetete u zavisnosti od stupnja devitrifikacije staklaste osnove. Izvršeno je šest kemijskih analiza i petrokemijskih proračun vulkanskih fragmenata. Ističe se visoki sadržaj SiO_2 od 71% do 76%, po čemu spomenuti varijeteti odgovaraju visoko - silicijskim riolitima, smanjeni sadržaj femske komponente i CaO, te visoki sadržaj alkalijske komponente, obično uz jasno prevladavanje K_2O nad Na_2O.

Vulkanske stijene kod Dolova (2 km istočno od Zdenaca) prvi obrađuju PAMIĆ i ŠPARICA (1988), gdje utvrđuju njihov sinsedimentacijski odnos s badenskim laporovitim biomikritima. Te stijene mogu se pozitivno korelirati s riolitnim vulkanoklastitima iz kamenoloma Zdenci.

PLATE - TABLA I

1. Very sandy biosparite. N+ ; 25x / Jako pjeskoviti biosparit. N+ ; 25x
2. Crystallovitrophyric rhyolitic tuff. N- ; 43x / Kristalovitrofirni riolitni tuf. N- ; 43x
3. Vitrocrystalline rhyolitic tuff. N- ; 86x / Vitrokristalni riolitni tuf. N- ; 86x



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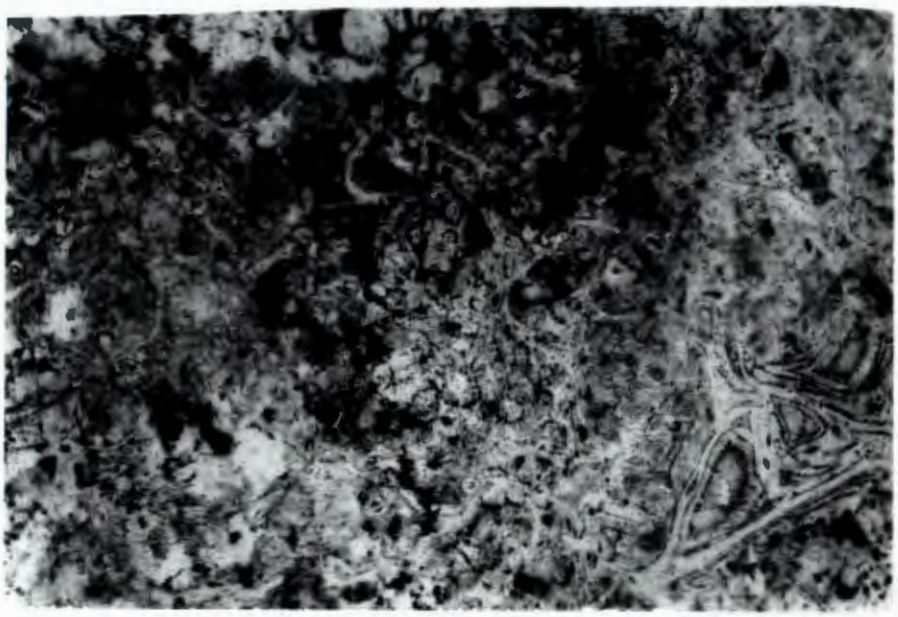

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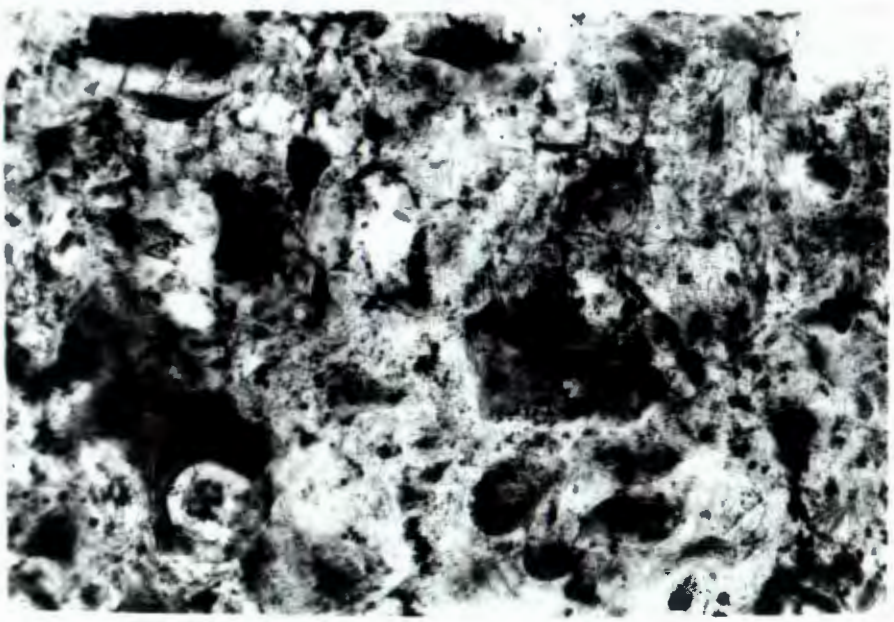

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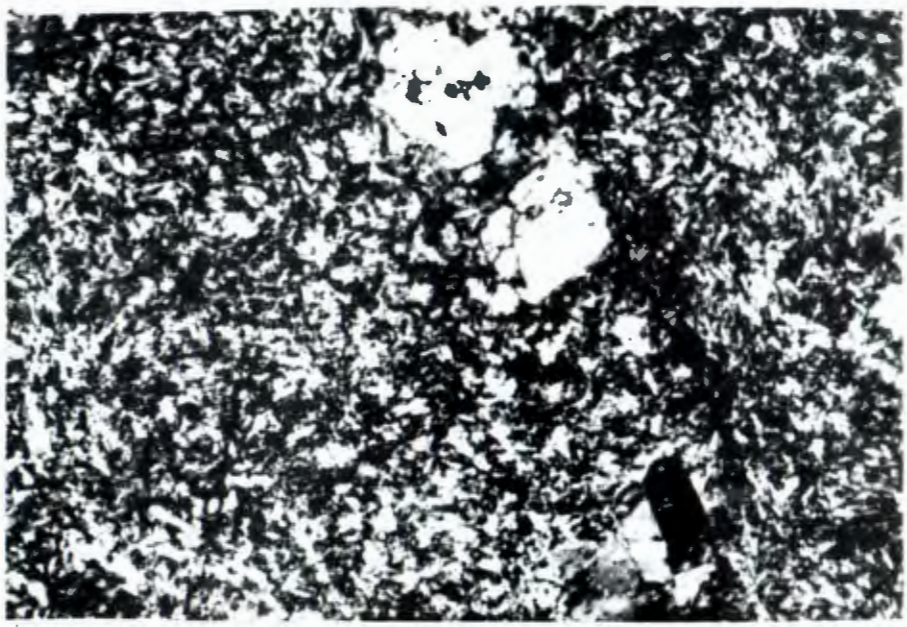
PLATE - TABLA II

1. Slightly porphyritic alkali-feldspar rhyolite. N+ ; 43x / Slaboporfirni alkalijsko-feldspatski riolit. N+ ; 43x
2. Aphyric alkali-feldspar rhyolite. N+ ; 86x / Afirni alkalijsko-feldspatski riolit. N+ ; 86x
3. Spherulitic alkali-feldspar rhyolite. N+ ; 86x / Sferulitni alkalijsko-feldspatski riolit. N+ ; 86x



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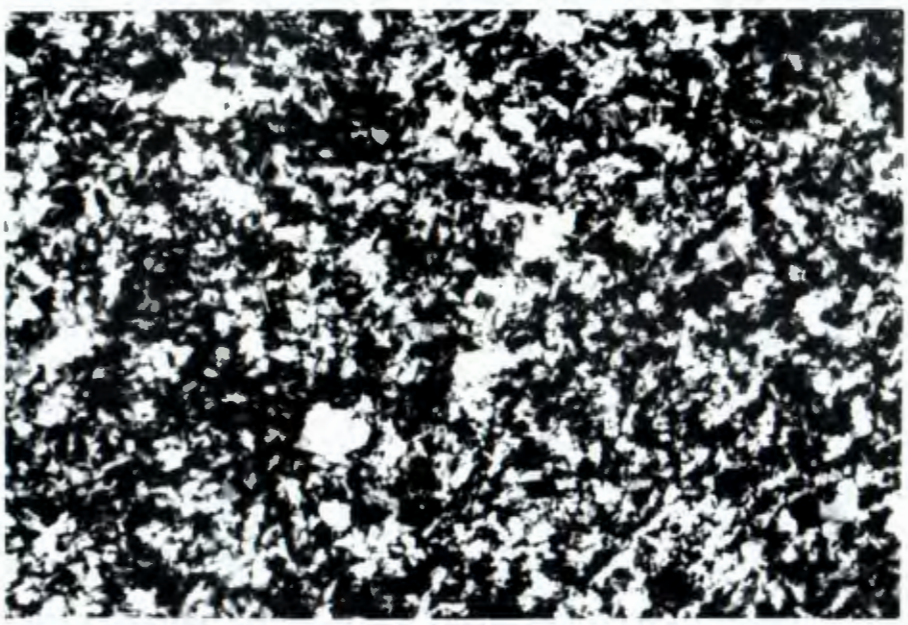

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