PRE-VARISCAN AND VARISCAN EVENTS IN THE ALPINE-MEDITERRANEAN MOUNTAIN BELTS

Regional Contributions

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H. W. FLÜGEL, F. P. SASSI

and P. GRECULA

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Results of biostratigraphical investigations in Western Yugoslav Paleozoic realized in IGCP Project No. 5

A. RAMOVŠ[1]. J. SREMAĆ[2] and E. KULENOVIĆ[3]

[1]*School of Science and Technology, Institut of Geology and Paleontology, University Edvard Kardelj, Aškerćeva 12, 61000 Ljubljana, Yugoslavia*

[2]*Department of Geology and Paleontology, Faculty of Sciences, Socialističke revolucije 4, 41000 Zagreb, Yugoslavia*

[3]*Republic Committee for Energy and Industry, 71000 Sarajevo, Yugoslavia*

Abstract

In Slovenia. North-West Yugoslavia, the Lower Devonian beds have been proved by a rich conodont fauna. The new reconstructed apparatus of *Belodella* is the most interesting conodont element. The Lower Carboniferous conodont fauna was investigated. 32 new localities of the Carboniferous continental flora in the clastic sediments of the Sava folds were discovered and investigated; in the Western Karavanke Mts. Stephanian flora was determined. The continental Groden (Val Gardena) Beds were studied in details. A very interesting Middle Permian reef limestone (= *Neoschwagerina* limestone) may have resulted in the formation of a mixed inorganic/organic build up, corresponding to caicisponge/algal/cement reefs. The Upper Carboniferous and Permian chonetacean brachiopods have been studied, four new genera have been described. The Permian brachiopods have been studied in the Velebit Mts. The Permian/Triassic boundary was studied in Slovenia and Croatia. In Bosnia many very important new localities with a rich Lower Devonian conodont fauna were discovered. A new reconstructed apparatus of *Belodella* was discovered. The microfacies of the well known *Bellerophon Beds at Han Orahovicu has been studied.*

Introduction

In the IGCP Project No. 5 a Yugoslav working group investigated in detail the Devonian. Carboniferous and Permian beds in Slovenia, the Permian brachiopods in Croatia, and the Lower Devonian beds (previously, undefined Carboniferous and Permian) in Bosnia. Conodonts and Permian Brachiopods were studied in greatest detail.

Stratigraphic correlation forms (SCF) and remarks on the SCF forms in Yugoslavia were given by Ramovs et al. (1984), for the IGCP Project No. 5 in Newsletter 6. 81—109. In addition to the exhaustive data we present the results of our further investigations on the Western Yugoslav Paleozoic which have not been published so far. These investigations led to new and very important conclusions on the stratigraphical subdivision of Devonian and Upper Paleozoic beds. Also microfacies studies have been undertaken.

Paleozoic in Slovenia

Devonian

In the Central Karavanke Mts. (Solcava area: Pavliceve stene, Mali and Veliki vrh; Fig. 1) a new Lower Devonian conodont fauna has been discovered. The conodonts were investigated in detail, and the first reconstructed Devonian skeletal apparatus in Slovenia was found. These conodonts are: *Belodela* with a new reconstructed apparatus, *Ozarkodina excavata wiirmi* (Bischoff and Sannemann), *Ozarkodina remscheidensis remscheidensis* (Ziegler), *Oneotodus beckmanni* (Bischoff and Sannemann), *Panderodus unicostatas* (Branson and Mehl), *Polygnathus* cf. *dehiscens* (Philip and Jackson) and *Polygnathus linguiformis* (Hinde) (Ramovs, unpublished). It has been proved that the Lower Devonian, the Upper Emsian and the Lower Middle Devonian are represented by light grey massive Stromatoporoida and Hiliolitida limestone. Crinoidal limestone occurs, too.

Carboniferous

In the,Central Karavanke Mts. (Jezersko area), autochthonous Lower Carboniferous reddish, grey and yellowish limestones contain a monotonous conodont fauna. The following species were determined: *Gnathodus bilineatus bilineatus* (Roundy), *G. pseudosemiglaber* (Thomspon and Fellow), *Paragnathodus commutatus commutatus* (Branson and Mehl), *P. commutatus nodosus* (Bischoff), *P. commutatus mononodosus* (Rhodes, Austin and Druce), *P. commutatus punctatus* (Bischoff), *Polygnathus* sp., *Spathognathodus campbelli* Rexroad. They prove the *Pericyclus* and *Goniatites* stages. The lowermost Carboniferous could not be defined anywhere in Slovenia.

Kolar-Jurkovsek and Jurkovsek. 1985 have started a systematic study of the Paleozoic macroflora in clastic sediments of the Sava folds. Because of the insufficient paleontological evidence, the age of these sediments has not been yet clearly determined, except in a few places. There was no agreement on the stratigraphie position of the rock succession: some

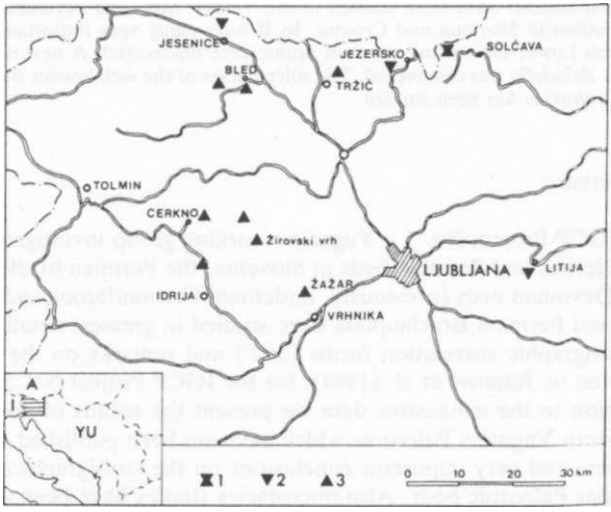

Fig. 1. Index map of Slovenia showing the Paleozoic beds. 1 — Devonian, 2 — Carboniferous, 3 — Permian

authors compared them with the Gailtal Beds, and others with the Hochwipfel Beds. Consequently, and for practical reasons only, they have been ranged as "Permocarboniferous". The authors examined 32 localities in the area between Jance and Polsnik from where they collected some hundred specimens of the Carboniferous macroflora in which *Catamites* and gymnospermae associated with rare lycopods predominated. In a preliminary report, the results of the examination of the macroflora from three localities in the Sava folds area were given. A total of 18 Upper Carboniferous taxa were described and documented. The *Sigillaria elegans* (Sternberg) Brongniart, which was found in the Litija locality, proves the Namurian-Lower Westphalian age, and the *Lepidodendron* sp. (Bergeria state of preservation) from the Jance locality most probably belongs to the Upper Carboniferous. From a rich fossiliferous bed, south of Litija, the following species have been described: *Sigillaria* cf. *boblayi* Brongniart, *Stigmaria* cf. *ficoides* (Sternberg) Brongniart, *Catamites haueri* Stur, *Calamites* cf. *cistiiformis* Stur, *Catamites* sp. A, *Catamites* sp. B, *Catamites* sp. C. *Cordaites* sp., and *Artisia* sp. The flora from the Sava folds contains some species characteristic of the Euro-American province, and indicates a swamp environment.

In the Karavanke Mts. the Upper Carboniferous is characterized partly by shallow marine and partly by continental sedimentation (Auering type sediments = molasse fades); it is very rich in calcareous algae, fusulinids, molluscs, brachiopods, bryozoans; trilobites are very frequent. Continental plants, very rich in individuals but poor in species, were found only in one outcrop in the Planina pod Golico village, Jesenice area. Dark fossiliferous shale'alternates with fine-grained micaceous sandstone. The sequence is only about 1 m thick. Wagner has identified the following: *Polymorphopteris polymorpha* (Brongniart) Wagner, *Pecopteris* sp. cf. *hemitelioides* Brongniart, *Pecopteris* fruct. indet.. *Pecopteris* sp. indet., *Annularia stellata* (Von Schlotheim) Wood, *Acitheca polymorpha* (Brongniart). *Lepidodendron* cf. *scutatum* Lesquereux, *Sigillaria brardi* Brongniart, *Calamites carinatus* Sternberg. No pteridosperms could be found, so this flora could not be dated more accurately than Stephanian.

Pecar (1985) studied the Upper Carboniferous (Karavanke) and the Permian chonetacean brachiopods in Slovenia (unpublished). Within the chonetacean Anopliidae family two genera were found: *Pygmochonetes(T)* and *Costachonetes.* In the Rugosochonetidae family the *Neochonetes (Neochonetes)* and *Neochonetes (Sommeriella)* subgenera were established. It is higly interesting to note that two distinct chonetacean with a median lobe were found in the same Gzhelian Beds. One of them belongs to the already known genus, while the other form will be described as a new genus. The already known genus with the median lobe is present also in the Lower Permian Trogkofel limestone which also contains the possible descendant of the other, the new Gzhelian chonetacean genus with the median lobe.

In the Upper Permian 2azar limestone another, coarse costate chonetacean species has been discovered (the study of this species is a continuation of the investigation by Ramovs, 1985, p. 497). This species is difficult to place among the already known chonetacean genera, but it belongs to the new *Volakochonetes* genus (Ramovs and Pecar, Manuscript in preparation for Geologija).

Permian

The most interesting new results of research on the Permian in Slovenia concern the significant discovery of a Lower Permian conodont association. The *Neogondolella slovenica* Ramovs has been described as a new platform element of the enantiognathiform. hibbardelliform, hindeodelliform, ozarkodiniform and pollognathiform elements. This assemblage is accompanied by the *Anchignathodus minutus* (Ellison) and the *A.* cf. *latidentatus* Kozur.

These conodonts were found only in one locality in some beds of the upper Lower Permian which is represented by dark gray sandstones and shales with small black linestone lenses. The highly developed *Pseudofusulina (Pseudofusulina* cf. *rakoveci* Kochansky-Devidé), accompanied by a crinoid *Palermocrinus togatus* Sieverts-Doreck in white and reddish limestones and marls proves that the entire section belongs to the *Misselina* zone (Ramovs, 1982a).

Pecar (1985) initially proposed the division of the lower part of Trogkofel limestone in the classical locality of Dolzanova soteska (Dolzan Gorge, Karavanke Mts.) into four members (from below upwards): the Shale Member, Reef Member One, the Layered Member, and Reef Member Two (unpublished).

Skaberne (unpublished) studied in detail the continental Grôden (Val Gardena) Beds in Western Slovenia. In the Ziri region in Western Slovenia, the Val Gardena (Grôden) sandstones overlie discordantly dark gray shales probably of Upper Carboniferous age. The thickness of Val Gardena sandstones varies from 200 m to 1 420 m over a distance of less than 25 km.

Mlakar (unpublished) divided the Val Gardena sandstones into six superpositional units. According to the lithostratigraphic classification they correspond to the formations which have not been definitively defined yet. With thorough field and laboratory work it was possible to define vertical and lateral relations of clastic lithofacies and vertical changes irtthe composition of lithical grains are considerable and can be used for lithostratigraphical correlation. In the lower part of Val Gardena sandstones volcanic source material prevails, while in the upper part metamorphic source material is dominant. The difference does not exist only in the composition of terrigenous grains, but also in the diagenetical evolution of Val Gardena sandstones.

Val Gardena sandstones in Western Slovenia were formed in a continental, mostly fluvial, sedimentary environment with numerous sub-environments: braided and meandring streams, fluvial fans and playa lakes. The deposition began in the depression of a preexisting paleorelief. The investigated area is interpreted as the south-western margin of a filled-up river valley whose axis extends south-easterly. Material was generaly transported along the axis to south-east. The tectonic events which caused a relative uplift or a subsidence which resulted in a change of the river profile relative gradient had the most important influence on the sedimentation of Val Gardena sandstones. The greatest differentation was observed in the lower part, and a lesser one in the middle and upper parts of Val Gardena sandstones. At the time of the sedimentation at least two to three distinct renewals of the relief can be documented.

Continental sedimentation of Val Gardena sandstones ended with the Upper Permian marine transgression which produced dolomites and limestones having the characteristics of lagoon and restricted shelf environments (Ramovs and Skaberne, 1985).

Macrofossils are not mentioned in the Val Gardena Beds. The pollen assemblage contains rather abundant monosaccate pollen grains of *Crucisaccites variosulcatus* Djupina associated with a small number of *Cordaitina* grains. Bitaeniate forms of *Corisaccites* and *Lueckisporites* are presumed to occur, but could not be distinguished reliably enough (Jelen, Budkovic and Grad, 1981).

With respect to the mineral deposits in the Middle Permian beds the uranium deposits in Zirovski vrh and the Skofje copper deposits should be mentioned (Drovenik, 1984).

The Zirovski vrh uranium deposits ate localized in the lower part of the Grôden (Val Gardena) sequence where the colour of clastic rocks is predominantly gray. The ore-bearing zone, nearly 125 m thick, includes more than 100 lenticular and elongated ore-bodies running along paleochannels. Pitchblende, coffinite and numerous sulfide minerals are found in clastic rocks which contain anthracitized and silicified plant remnants. Sulfide sulfur is ^{34}S-enriched; ô-"S values are spread over a very broad range, from + 2,52 **‰** to — 36.8 %<.

In the upper part of the Groden (Val Gardena) clastic sedimentary rocks, where the red coloured varieties predominate, numerous outcrops with primary or secondary copper minerals extend in a nearly 90 km long belt. In the Škofje copper deposits lenticular, more or less concordant ore-bodies contain chalcopyrite, bornite, chalcocite and pyrite in dark gray, gray as well as in green clastic rocks. $\delta^{34}S$ oscillates from — 8,79 ‰ to — 37,93 ‰.

In the continental Groden (Val Gardena) clastic rocks the two types of deposits belong to the group of red bed deposits. The bleaching of primary red sediments, ore fabrica, the association of mineralization with carbonaceous material, mineralogical characteristics and a sulfide-sulfur isotope composition, all indicate a diagenetic origin of uranium and copper minerals.

The very interesting Middle Permian reef limestone (= Neoschwagerina limestone) in the surroundings of Bled, in the Julian Alps, has been studied additionally by Flugel, Kochansky-Devide and Ramovš (1984) with respect to microfacies and paleontological criteria.

Allochthonous carbonates (limestone breccia represented by cement-rich litho/bioclastic rudstones; matrix-rich poorly sorted litho/bioclastic rud/floatstones; coarse-grained lithociastic packstones) are present in far greater quantities than autochthonous carbonates (calcisponge boundstones and *Archaeolithoporella/cakisponge* boundstones with syn-sedimentary botryoidal carbonate cements; bioclastic crinoidal packstones) in the Straža quarry-The Straža is characterized by fine arenitic bioclastic grainstones with foraminifera and algae.

The biota of these limestones consist of calcareous algae (solenoporaceans, dasycladaceans, epimastoporids) and problematical algae *(Archaeolithoporella, Tubiphytes),* smaller foraminifera (about 30 species), fusulinid foraminifera (with *Neoschwagerina craticulifera* and the first report of the subgenus *Minojapanella (Wutnella)* from Europe, calcisponges (sphinctozoans and inozoans: new species: *Uvanella telleri* Flugel), brachiopods (above 12 species also including fixosessile types such as *Leptodus nobilis).* bryozoans (predominantly Cystoporida and Phabdomesonida), as well as molluscs (gastropods, pelecypods, rare ammonites), ostracods. rare trilobitea. rare rugose corals and abundant crinoids (including *Palermocrinus togattts)* and echinoids. tube-like microfossils of various systematic position, can be attributed to nine morphological types.

The limestone breccia is characterized by a rather uniform composition (with regard to the microfacies of the lithoelasts). by equigranular lithoclasts, by comparable sorting within different fades types, and by the predominance of subangular and rounded lithoclasts of medium to high sphericity values. Interparticle voids within the litho/bioclastic rudstones, as well as intraskeletal voids within the calcisponge/**algal** limestones are filled with botryoidal and radiaxial-fibrous cements which differ from the granular cements of pelsparitic clasts.

The Straža quarry and Straža hill exhibit different depositional patterns (allochthonous sedimentation together with small areas of autochthonous calcisponge/algal framework in the Straža quarry and shallow-water platform carbonates in the Straža hill). The depositional sites of the allochthonous faeies tvpes can be compared neither with back-reef environments nor with fore-reef breccia. Both the litho/bioclastic rud- and the float-stones and calcisponge/algal boundstones were affected by a contemporaneous synsedimentary cementation: growth and coalescence of botryoids together with algal colonization and the growth of calcisponges may have resulted in the formation of a mixed inorganic/organic build up, corresponding with calcisponge/algal cement reefs.

In the amphitheatric limestone wall behind the Bohinjska Bela village reef limestone prevails (calcisponge/algal reef); breccia, however, could not be observed. Small coral patch reefs, brachiopod and *Neoschwagerina* lenses are the most characteristic features in this locality.

Permian—Triassic boundary

Ramovs (1982b) studied the Permian-Triassic boundary: The uppermost Permian and the lowermost Triassic outcrop in Slovenia in Karavanke Mts., especially in their western part, in the Ljubljana area (Central Slovenia), in the surroundings of Idrija and Cerkno (W. Slovenia), and in the Sava folds. In the mentioned areas sedimentation proceeded concordantly accross the Permian-Triassic boundary with but a short interruption. At that time no tectonic movements took place in the Southern Alps and the Western Dinarids. The faunistic boundary in the Permian transition is less characteristic. In the Permian, as well as the lowermost Triassic, the ammonites are extremely rare. In the uppermost Permian strata there are no brachiopods of the Caucasus and Indoarmenia type. The corals *(Waagenophyllum)* also do not extend into the Permian-Triassic boundary. In the youngest Permian strata there are only typical calcareous algae (Gymnocodiaceae), small foraminifers and remains of echinoderms. Only for the Travnik locality (near Idrija) it is characteristic that some *Staffella* and *Nankinella* fusulinid foraminifers still occur some meters below the Permian-Triassic boundary. Palynological research of the Upper Permian rocks in Slovenia appears to have been unsuccessful.

In all the sections examined up to date in Slovenia the Permian-Triassic boundary is placed at the end of the sedimentation of Permian character (black and dark gray well bedded limestone or dolomite) with Gymnocodiaceae and small foraminifers, marked by a thin marly or clayey bed. It is followed by a light gray banded sparitic lowermost Triassic dolomite or dolomitic limestone which, according to present knowledge, does not contain any fossils.

Paleozoic of Croatia

Permian

In Croatia (in the area of Brusane and Baske Ostarije — Velebit Mt.; Fig. 2) a rich brachiopod fauna collected in the Middle Permian limestones was studied in most detail (Sremac, in print in Paleont. jugosl., Zagreb). Thirty-eight different forms have been described, including the new family: Ramovsiinidae (Strophalosiacea) with *Ramovsina* n. gen. The new family is characterized by the pecular quadri-lobed cardinal process and by hollow spines on interarea. The new genus: *Megatschernyschewia* (Tschernyschewiidae) with several new forms: *M. longiseptata lata* Sremac and *M. kochanskae* Sremac, as well as the new species of *Enteletes (E. salopeki* Sremac) and *Martinia (M. velebitica* Sremac), and the new subspecies of *Keyserlingina (K. filias* Sremac) have been also determined. Most of the specimens from Lika belong to the Indo-American type of fauna which colonized the Upper Paleozoic tropic and subtropic seas of Europe, Asia and America. Two main types of brachiopod communities can be distinguished:

1. Reef-type community, characterized by large specimens with thick shell-walls, often asymmetrical in shape and ornamentation. Most of the adult brachiopods lived unattached among the main reef-builders (Calcispongiae, Hydrozoa, Bryozoa), together with gastropods, cephalopods and bivalves. Coral communities *(Waagenophyllum* sp.) have been found sporadically. The reef type fauna is characterized by a small number of taxa, but by an enormously large number of specimens.

2. Calm marine environment enabled colonization of the much larger number of brachiopods, predominantly productoid taxa. Productoids (1 or 2 representatives of each form) were anchored by spines in the muddy substrate. Large shells *(Ramovsina)* were also supported by gutter. Attached forms *(Keyserlingina* and *Leptodus)* with a large number of

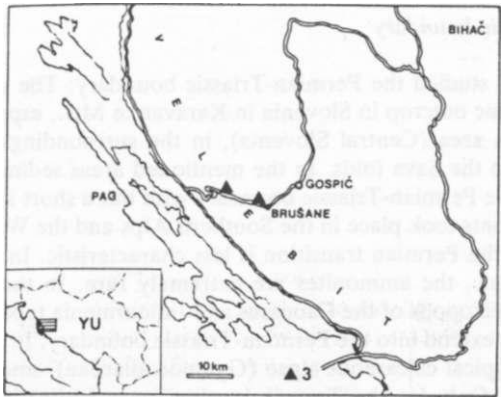

Fig. 2. Index map of Croatia showing the Paleozoic beds. 3 — Permian

specimens have been found in the separate stratum.

The sedimentation of the Permian in the Velebit Mt. ended with the "border dolomite".

Permian-Triassic boundary

Continuous transition from the Upper Permian "border dolomite" into the Triassic has been observed in Banija region, Somoborska gora mountain and Velebit Mt. (Ramovs and Kochansky-Devide, 1981, 327—330).

Paleozoic in Bosnia

The data on the Paleozoic of North-West Bosnia (Sana-Una Paleozoic), the Paleozoic of Central Bosnia, the Paleozoic near Kljuc in West Bosnia, and the Paleozoic of East Bosnia were published by Kulenovic, in 1983.

In the years 1982—1985, the Paleozoic of South-East Bosnia was frequently studied (Fig. 3). The presence of the Lower Paleozoic, above all of the Lower Devonian, assigned till 1982 only to the non-subdivided Carboniferous and the Permian, changed our understanding of the stratigraphical development, as well as of the structural characteristics of the Paleozoic of South-East Bosnia.

Devonian

In the valley of the Kamenicka reka river on the northwestern side of the Klek Mts., dark gray limestone intercalations in the elastics which were formerly attributed to the Carboniferous and the Permian contain the following conodonts: *Belodella triangularis* reconstructed apparatus. (Stauffer, 1940), *lcriodella* sp., *Oneotodus beckmanni* Branson and Sannemann, *Ozarkodina remscheidensis remscheidensis* (Ziegler), *O.* cf. *stygia* (Flajs), *Pandorinellina* cf. *optima* Moskalenko, *Pedavispesavispesavis* (Bischoff and Sannemann). They prove the Lower Devonian age. Fine-grained reddish elastics with a *Styliolina* have been discovered in this area for the first time.

On the opposite side of the Klek Mts. (south-east slope) near the Boskovici village the

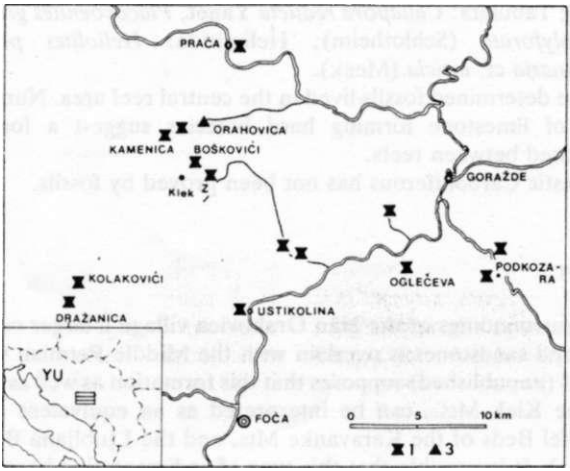

Fig. 3. Index map of Bosnia showing the Paleozoic beds. 1 — Devonian, 3 — Permian

intercalated gray limestone contains: *Belodella triangularis* Stauffer. *Hindeodella* sp., *Oneotodus* cf. *beckmanni* Bischoff and Sannemann, and *Panderodus unicostatus* (Branson and Mehl). it was assigned to the Lower Devonian.

Limestones outcropping in elastics in several places on the right valley slope of the Vrbicka rijeka River belong partly to the Upper Silurian and the Lower Devonian. A similar position shows the profile below Gorazde—Cajnice at the Podkozara village (Ramovs and Kulenovic, 1982).

Recent investigations (Ramovs. unpublished) confirmed the Lower Devonian in some other localities in North-East Bosnia. On the slope above the Drazanica valley the Lower Devonian reddish, gray and black limestones have been established by the following conodonts: *Oneotodus*". *beckmanni* Bischoff and Sannemann. *Ozarkodina excavata wurmi* (Bischoff and Sannemann). *Ozarkodina inclinata inclinata* (Rhodes), *Ozarkodina remscheidensis remscheidensis* (Ziegler), *Ozarkodina* cf. *transitans* (Bischoff and Sannemann), *Panderodus gracilis* (Lindstrom and Ziegler), and *Panderodus unicostatus* (Branson and Mehl). The following ramiform conodont elements occur: hindeodelliform, ligonodiniform, plectospathodiform. prioniodiniform, and trichonodelliform elements.

On the right slope of the Kolakovici potok Brook near the village of Kolakovici the Lower Devonian has been proved by the following conodonts: *Belodella triangularis* (Stauffer). *Icriodus postwoschmidti* Mashkova. *Ozarkodina excavata wurmi* (Bischoff and Sannemann). *Ozarkodina remscheidensis remscheidensis* (Ziegler), and *Panderodus unicostatus* (Branson and Mehl).

In the surroundings of this outcrop the age of bedded reddish limestone could not be prosed bv conodonts.

The Lower Devonian limestone interpreted as of basinal environment shows, in South-East Bosnia, a development similar to that in the Central Karavanke Mts.

The Upper Emsian and the Middle Devonian, represented by the Klek limestone, is well developed on the Klek Mts. It contains corals and stromatoporids (Kostic-Podgorska. 1958). A new locality of the Upper Emsian and Middle Devonian platform massive carbonates was discovered on the right slope of the Kolakovici potok Brook. Turnsek has preliminarily determined the following fossils: Stromatoporoida: *Actinostroma stellulatum* Nicholson, *Anostvlostroma lozvense* Yaworsky, *Stachyodes* cf. *costulata* Lecompte. *Stromatopora concentrica* Golffuss. *Stromatopora* sp.. *Stromatoporella iaminata* (Bar-

gatzky); Tabulata: *Caliapora reducta* Yanet, *Placocoenites gradatus* (Lecompte), *Thamnopora polyforata* (Schlotheim); Heliolitida: *Heliolites porosus* (Goldfuss); Rugosa: *Hexagonaria* cf. *articla* (Meek).

The determined fossils lived in the central reef area. Numerous fragments of fossils and pieces of limestone forming hard breccias suggest a fore-reef breccia, or a breccia sedimented between reefs.

Clastic Carboniferous has not been proved by fossils.

Permian

In the surroundings of the Han Orahovica village a larger complex of black and dark gray shales and sandstones is overlain with the Middle Permian Groden (Val Gardena) strata. Ramovs (unpublished) supposes that this formation as well as the dark shales and sandstones near the Klek Mts., can be interpreted as an equivalent of the Lower Permian clastic Trogkofel Beds of the Karavanke Mts. and the Ljubljana Beds in the Sava folds (Central Slovenia). It is possible that this type of sedimentation began in the Upper Carboniferous and continued throughout the Lower Permian. No palynomorphs could be found in the three samples taken for pollen analysis in the surroundings of the Han Orahovica village.

Violet reddish and wine-red Groden (Val Gardena) shales and fine grained sandstones contain, in the upper part of the section, lenses of gray dolomite and dolomitic marl, thick up to 40 cm. The same observation could be made in the Karavanke Mts., so this sequence cannot be interpreted as the lowest part of the Upper Permian Bellerophon Beds.

Microfacies of the well known *Belerophon* Beds at Han Orahovica has been studied by Ramovs (unpublished). Very rich and partly nearly autochthonous macrofauna and microflora are limited only to thin layers. The pre-dominant beds, however, contain resedimented fossils: fragments of lammelibranchs and brachiopods, remains of crinoids, gastropods and calcareous algae. Very rare are Nautiloids. Very characteristic *Permocalculus fragilis* biolite and *Permocalculus fragilis*/*Gymnocodium bellerophontis* biolite occur in some thin layers. Locally dense packed calcareous algae compose the intrabiomicrite. Some beds represent a fine micritic limestone with sporadic fossils. In the algal limestone a very small foraminifer *Glomospira* is rather frequent, but it could not be observed in other types of the Upper Permian limestone.

The paleoecological analyses of microflora and macrofauna and some descriptions of the *Bellerophon* fauna were presented by Kostic and Podgorska (1958. 114—117).

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