SUBTIDAL-SUPRATIDAL CYCLES IN THE LATE PERMIAN OF THE VELEBIT MT. (CROATIA)

Jasenka Sremac[1], Haris Ibrahimpašić[2] & Davor Kudrnovski[3]

1 Faculty of Science, Department of Geology, Institute of Geology and Palaeontology, Horvatovac 102 a, 10 000 Zagreb, CROATIA, e-mail: jsremac@inet.hr ;
2 INA Oil Industry, Šubićeva 29, 10 000 Zagreb;
3 Faculty of Science, Department of Geology, Institute of Mineralogy and Petrology, Horvatovac b.b., 10 000 Zagreb.

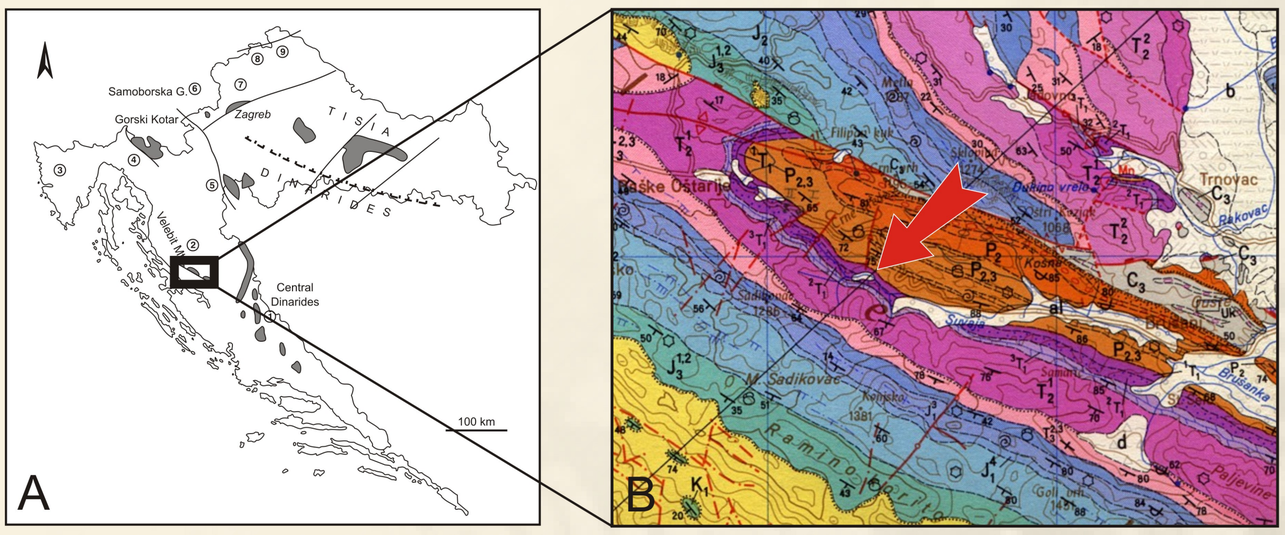
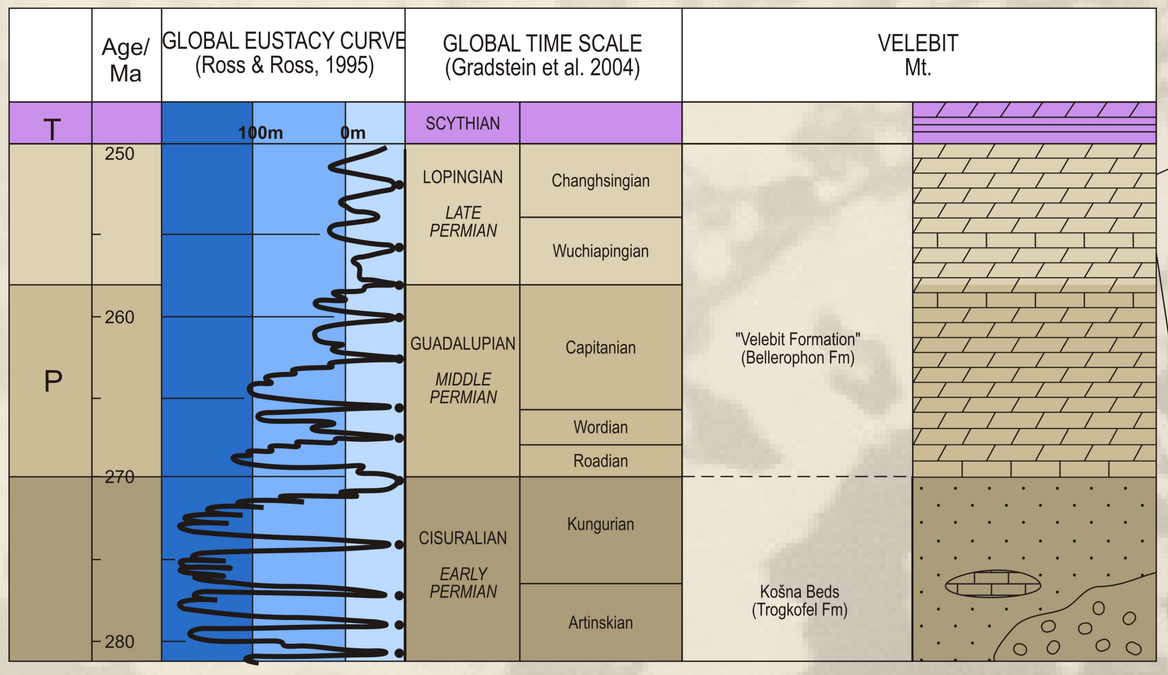


Fig.1.
A. Schematic map of Palaeozoic outcrops in Croatia (SREMAC, 2005), showing the position of the research area.
B. Detail from the Basic geological map 1:100 000, Sheet Gospić (SOKAČ et al., 1967). Suvaja Creek section is marked with red arrow.

During the Middle and Late Permian a shallow water platform deposition took place in the area of the Velebit Mt. (SW Croatia) (Fig.1). Early- to late-diagenetic dolomites predominate, with sporadic intercalations of black limestones and shales (Figs.2A,B).

Age of these rocks was determined on the basis of microfossils (KOCHANSKY-DEVIDÉ, 1965). Fossils are the most diverse and best preserved in limestones (Fig.3A), while they can be hardly recognized in late-diagenetic dolomites. Impoverishment of biota can be noticed in Late Permian, particularly near the Permian-Triassic transition, followed by the decrease of $\delta^{13}C$ in carbonates and kerogens (FIO et al., 2006). Fusulinids, which are the best index fossils, are the first to disappear, while calcareous algae and small benthic foraminifera can be found in the Uppermost Permian deposits (Figs.3B,C).



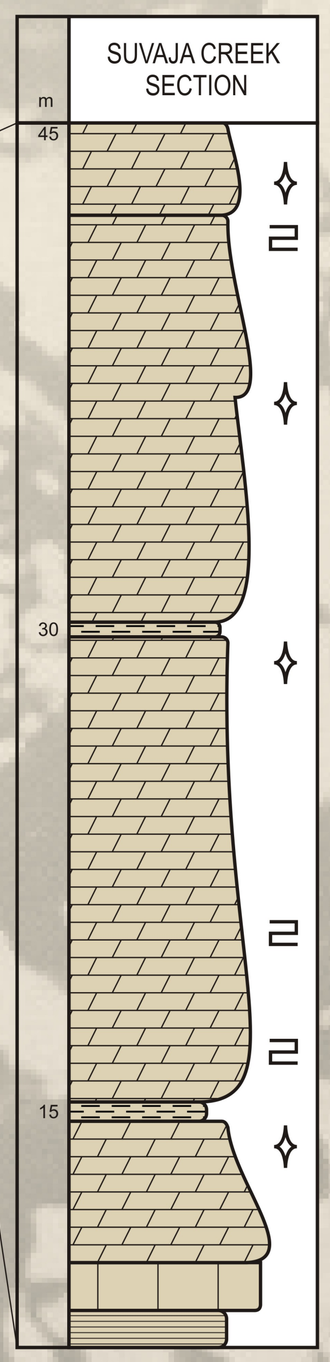


Fig.2.
A. Schematic geologic column through the Permian deposits from the Velebit Mt., with respect to the global time scale (GRADSTEIN et al., 2004) and global eustacy curve (ROSS & ROSS, 1995).
B. Detailed geologic column from the Suvaja Creek section (Central Velebit Mt.) exhibiting several depositional cycles (partly after IBRAHIMPAŠIĆ & SREMAC, 2002).

Supratidal, intertidal and shallow subtidal facies can be discriminated on the basis of sedimentary features and fossil assemblages. Evidences of temporary regressions become more prominent in the Late Permian (Fig.2B).

Clastic intercalations within dolomites are of terrestrial origin, which can be confirmed by geochemical data. During the Middle Permian and partly in the Upper Permian black shales predominate, sometimes rhythmically alternating with bioclastic packstones-grainstones (SREMAC, 1991). They contain large amount of thermically altered organic matter. Deposition within a restricted shallow bay, or lagoon was presumed. In the Uppermost Permian dolomites red-colored intercalation of siliciclastic rocks appear, increasing in amount towards the P/Tr transition. More oxidizing conditions were present, resulting in the enrichment in REE and negative Ce anomaly (FIO et al, 2006).

Solution vugs appear within the early diagenetic supratidal early diagenetic dolomites. Some of the vugs are geopetally infilled. Laminated stromatolites are probably of cyanobacterial origin, showing the fenestral fabric and tepee structures, typical for supratidal environment (Fig.3E). Temporary storms influenced the deposition of wackestones with mud clasts in lagoonal environments (Fig.3D), and chaotic bioclastic wackestones in more open environments.

Subtidal-supratidal cycles were repeated several times, partly following the global changes in sea level.

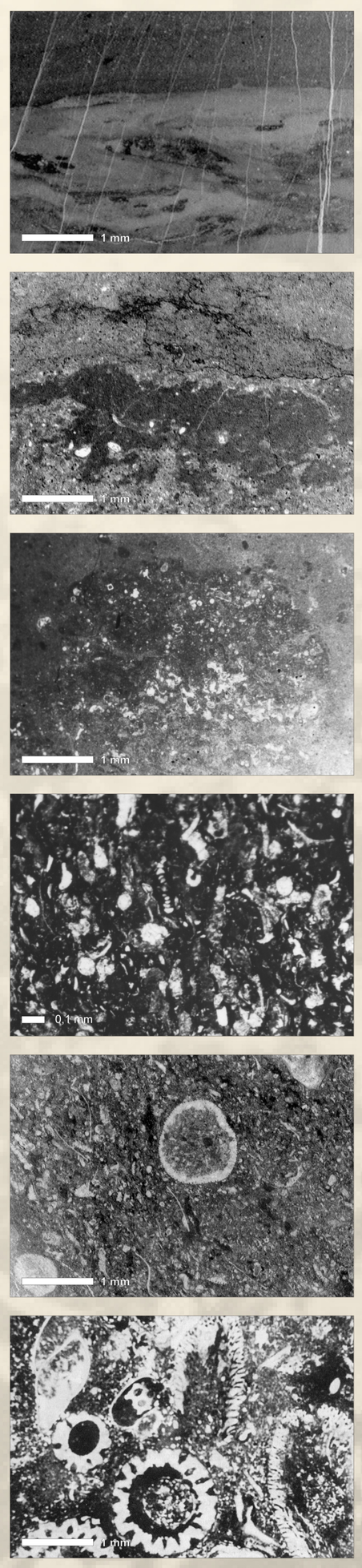


Fig.3.
A. Algal wackestone-packstone with Mizzia and Permocalculus, common in the Middle-Late Permian shallowsubtidal environments in the Velebit Mt.
B. Dolomitized gymnocodiacean wackestone from the Late Permian of the Suvaja Creek section.
C. Bioclastic wackestone with small benthic foraminifera (Hemigordius sp. div.), a common facies in Middle-Late Permian.
D. Irregular-shaped „muddy" lithoclast in muddy matrix. This type of floatstone is produced by storms in a very shallow lagoonal environment.
E. Hummocky-shaped stromatolites with vugs - remains of dissolved filaments. Stromatolites appear sporadically in Middle-Late Permian of the Velebit Mt., but they are very common in the lowermost Triassic dolomites. Microstylolites are visible above the stromatolite surface.
F. Lithoclastic floatstone with unfossiliferous micrite clasts, formed as log deposit in tidal channels, overlain with mudstone.

REFERENCES:

FIO, K.; SPANGENBERG, J.E.; SREMAC, J.; VLAHOVIĆ, I.; VELIĆ, I. & MRINJEK, E. (2006): Geochemical evidence for environmental changes at the Permian-Triassic transition, Mt. Velebit, Croatia. 16th Goldschmidt Conference, Melbourne-2006.

GRADSTEIN, F.M.; OGG, J.G. & SMITH, A.G. (2004): A geologic time scale 2004. Cambridge Univ. Press, 589 pp, Cambridge.

IBRAHIMPAŠIĆ, H. & SREMAC, J. (2002): End Permian Regression-Evidence from Meiobenthic Fossil Communities from the Velebit Mt. (SW Croatia). -The Third International Congress "Environmental Micropaleontology, Microbiology and Meiobenthology" EMMM´2002, Program & Abstracts / Yanko-Hombach, Valentina (edit.), 101-103, Beč.

KOCHANSKY-DEVIDÉ, V. (1965): Karbonske i permske fuzulinidne foraminifere Velebita i Like. Srednji i gornji perm. - Acta geol., 5, 101-137, Zagreb.

ROSS, C.A. & ROSS, J.R.P (1995): Permian Sequence Stratigraphy. - In: SCHOLLE, P.A.; PERYT, T.M. & ULMER-SCHOLLE, D.S. (Eds.): The Permian of Northern Pangea. Vol.1. Paleogeography, Paleoclimates, Stratigraphy. 98-123, 13 sl., Springer-Verlag, Berlin Heidelberg.

SREMAC, J. (1991): Zona Neoschwagerina craticulifera u Srednjem Velebitu. (Zone Neoschwagerina craticulifera in the Middle Velebit Mt. /Croatia, Yugoslavia/). Geologija, 34, 7-55, Ljubljana.

SOKAČ, B., ŠČAVNIČAR, I. & VELIĆ, I. (1976): Basic Geological Map of Yugoslavia 1: 100 000. Sheet Gospić, Beograd.

SREMAC, J. (2005): Equatorial Shelf of the Palaeozoic supercontinent Cradle of the Adriatic Carbonate Platform.Geol. Croat. 58/1, 1-19, Zagreb.