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Biostratigraphical correlation of spore and conodont zonations within Givetian and ?Frasnian of the Lublin area (SE Poland)

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ABSTRACT

Givetian and ?Frasnian spores associated with conodont elements occur in two boreholes in the Lublin area allowing definition of the stratigraphical relationship of the first appearance or last occurrence of selected spore species and form features to the conodont division. Spore data from a section lacking conodonts but correlatable on lithostratigraphy with the conodont bearing one are also considered. The spore zonal scheme for Western Pomerania is correlated with the conodont zonation. The first occurrence of *Chelinospora concinna* (base of the Ex 2 Subbiozone) and *Kraeuselisporites spinutissimus* are probably within the range of *rhenanus/varcus* to *ansatus* Biozones, not above the *ansatus* Biozone. The first occurrence of *Samarisporites triangulatus* (base of the Ex 3 Subbiozone) is in the *ansatus* Biozone. The disappearance of *Aneurospora extensa* (base of the Aur Biozone) is within the range of *ansatus* to *hermanni* Biozones. The species *Corystisporites pomeranius* and multifurcate-spined spores appear in the *falsiovalis* Biozone, probably in the Upper *falsiovalis* Biozone. The first occurrence of *Tholisporites densus* (base of the Den Biozone) is somewhat higher but still in the same biozone.

1. Introduction

The first comprehensive spore zonation scheme for the Devonian of the Old Red Sandstone Continent and adjacent areas was described by Richardson and McGregor (1986). Other, widely used schemes for the Devonian are that for the Ardenne–Rhine regions (Streel et al., 1987), and that for Eastern Europe (Avkhimovitch et al., 1993). The zonal boundaries of all those schemes are correlated with the conodont scheme and other schemes based on marine faunas, but these correlations are, in most cases, only approximate. Data on conodonts and spores recovered from the same section are rare. Spores were recovered from Siegenian to Famennian conodont-bearing strata in Melville Island (Canadian Arctic), but conodonts are only sparsely present there (McGergor and Uyeno, 1972). Most biostratigraphical contributions on spores from sediments dated by conodonts concern Western Europe (summarized in Streel, 2009). Givetian and Frasnian conodonts and spores have been recovered from sections in Boulonnais, France (Brice et al., 1979, 1981; Loboziak and Streel, 1980, 1981), and in the Eifel Mountains (Loboziak et al., 1991). Famennian spore assemblages were found in conodont dated sections in Belgium, in the Dinant Synclinorium, Ardennes (Loboziak et al., 1995; Maziane et al., 1999). Important spore and conodont data on the uppermost Famennian (Strunian), and the Devonian/Carboniferous boundary beds, have been presented by Higgs and Streel (1984). Both microfossil groups also occur in Givetian strata exposed in the Holy Cross Mountains (Malec and Turnau, 1997; Turnau and Racki, 1999).

The subsurface Givetian deposits of the Lublin area (Fig. 1) comprise alternating clastic, evaporite and carbonate rocks, and the Frasnian deposits are developed in carbonate–sulfate facies. Comprehensive information on geology of these deposits may be found in Miłaczewski (1981), Miłaczewski et al. (1983), and Narkiewicz et al. (1998). Conodonts and spores discussed in this paper are derived from two borehole sections situated in the central (Giełczew PIG 5) and southeastern part (Terebin IG 5) of the Lublin area. Spores were also found in the Giełczew PIG 6 borehole. The lithostratigraphic division of these strata, after Narkiewicz (personal communication, 2010) is shown in Figs. 2 and 3. The spore assemblages are assignable to the local scheme for Western Pomerania (NW Poland) as proposed by Turnau (1996, 2007). The assemblages contain some species of distinctive morphology and wide geographical distribution. Their importance for stratigraphy has been recognized by numerous authors, four are zonal index species, other may, in the future, be useful for subdividing the existing zones. The objective of this paper is to establish the stratigraphical position of the first or last appearances of these spore taxa, and some form features, in relation to the conodont zones, and to correlate the spore zonal scheme for Western Pomerania with conodont zonations. Our conclusions are based primarily on the results from the Lublin area, but revised conodont

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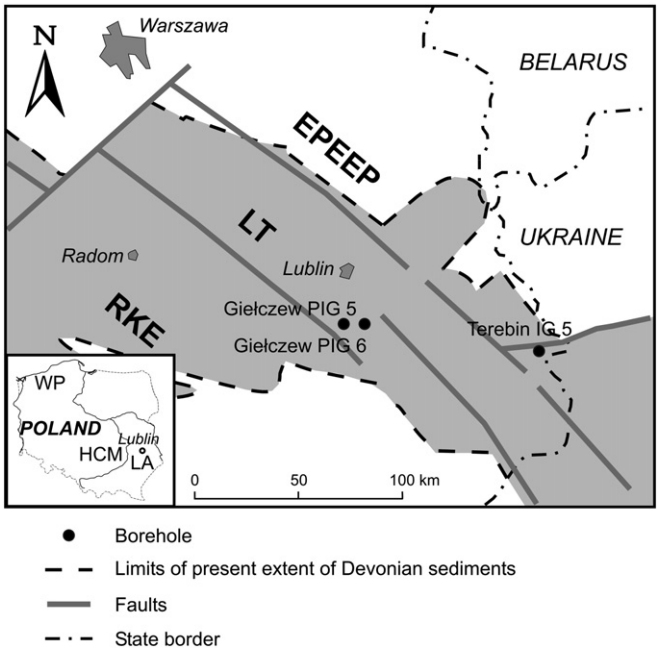

Fig. 1. Simplified location map of study area (after Pożaryski and Dembowski, 1983, altered); tectonic units: RKE — Radom–Kraśnik Elevation, LT — Lublin Trough, EPEEP — Elevated Part of East European Platform. Insert shows areas in Poland discussed in the text: WP — Western Pomerania, HCM — Holy Cross mountains, LA — Lublin area.

datings of spore biohorizons from the Holy Cross Mountains are also taken into consideration.

2. Conodont zonation

The shallow marine facies of the Givetian of the study area are not favourable for development of conodont faunas. Diversified and relatively abundant assemblages only occur in isolated carbonate layers representing open marine transgressive episodes (Figs. 2 and 3, see also Narkiewicz and Bultynck, 2007, fig. 7, 8). The interlayered carbonate, clastic, and evaporite successions contain poorer and less diversified microfauna or are entirely barren. The conodont assemblages represent polygnathid, through polygnathid–icriodid, icriodid–polygnathid to icriodid biofacies. Conodont stratigraphic division of the Middle Devonian is usually based on occurrence of index species characteristic of the deeper facies (see Ziegler and Klapper, 1982; Bultynck, 1987; Klapper and Johnson, 1990; Ziegler and Sandberg, 1990; Bultynck and Gouwy, 2008). Applicability of this zonation to shallower facies, where these species are rare or absent, is not satisfactory. Therefore, for the Givetian of the Lublin area, Narkiewicz and Bultynck (2007) applied an alternative conodont zonation. The division by Bultynck (1987) has been used for the Lower and Middle Givetian. New data on the *subterminus* fauna obtained in North America, Europe and North Africa allowed the introduction for the Upper Givetian of the *expansus* and *subterminus* Biozones (Narkiewicz and Bultynck, 2010). The index species of the former – *Icriodus expansus* Branson and Mehl, 1938 – is a deeper-water form, but is also encountered, though in lesser numbers, in shallow water facies. The *expansus* Biozone includes most of the *hermanni* Biozone, and the *disparilis* to *norrisi* Biozones (Fig. 4). The

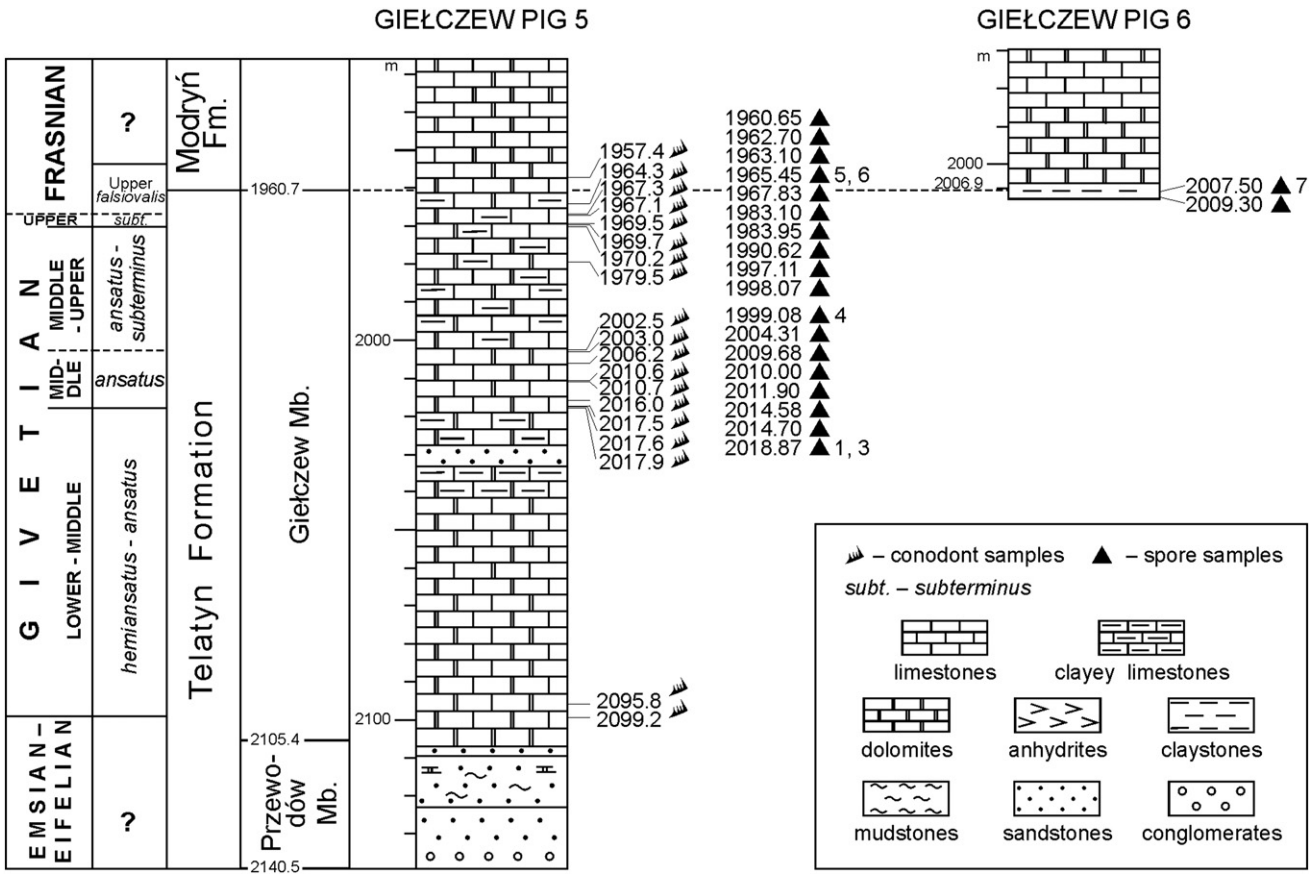

Fig. 2. Stratigraphy of pertinent part of Giełczew PIG 5 and Giełczew PIG 6 borehole sections, and location of conodont and spore samples. Numbers 1, 3–7 mark levels of species or morphological features first (FOB) or last (LOB) occurrence: 1. *C. concinna*, FOB, 3. *S. triangulatus*, FOB, 4. *A. extensa*, LOB, 5. *C. pomeranius*, FOB, 6. multifurcate-spined spores, FOB, 7. *T. densus*, FOB. Lithostratigraphic division after Narkiewicz (personal communication, 2010).