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BUNTSANDSTEIN MAGNETOSTRATIGRAPHY IN POLAND: NEW DATA FROM THE BRZEŚĆ KUJAWSKI IG-1 BOREHOLE

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Abstract: New magnetostratigraphic data from the Middle Buntsandstein section, drilled in the Brześć Kujawski IG-1 borehole (Central Poland), are presented and discussed. The chronostratigraphic positions of particular formations of the Buntsandstein are discussed as well. The magnetic polarity pattern obtained from the Brześć Kujawski IG-1 borehole matches the pattern obtained earlier in other boreholes from the Polish part of the Central European Basin. Although magnetostratigraphy and palynological evidence undoubtedly indicates that the Induan/Olenekian boundary in the Polish part of the CEB is located in the lower part of the Pomerania Formation, the placement of the Olenekian/Anisian boundary within the sedimentary sequences of the Central European Basin remains problematic. This boundary most probably is located within the upper part of the Upper Buntsandstein, as can be inferred from palynological studies.

Key words: Magnetic polarity, Lower Triassic, Central Poland.

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INTRODUCTION

The first reliable magnetic polarity pattern for the Buntsandstein deposits of the Central European Basin (CEB), which could be correlated successfully with magnetostratigraphic data from other basins, was established in its Polish (Nawrocki *et al.*, 1993; Nawrocki, 1997) and Lithuanian parts (Katinas, 1997). The basal normal polarity zone was correlated with the earliest Griesbachian normal-polarity record from Arctic Canada (Ogg and Steiner, 1991) and was defined in several drill cores within the lowermost Buntsandstein. Another thick zone of normal polarity, characteristic for the upper part of the Middle Buntsandstein section, was correlated with the Olenekian (Nawrocki, 1997). The normal- and reversed-polarity zones discovered in the Röt Formation were correlated with the lowermost Anisian (Nawrocki, 1997). Results of further magnetostratigraphic studies of the Röt Formation and the Muschelkalk carbonates from Upper Silesia and the Holy Cross Mts. together with biostratigraphic data indicated a late Olenekian age for the Röt Formation (Nawrocki and Szulc, 2000). In the Polish part of the CEB, a reliable pattern of magnetic polarity also was established for first time for parts of the Upper Triassic sequence (Nawrocki *et al.*, 2015; Wójcik *et al.*, 2017). For example, the Schlifsandstein beds were correlated (Nawrocki *et al.*, 2015) with the late Julian part of the Global Polarity Time Scale (GPTS; Gradstein *et al.*, 2012), which later was confirmed by Zhang *et al.* (2020).

Detailed magnetostratigraphic studies of the Buntsandstein deposits from the German part of the CEB were carried out by Szurlies *et al.* (2003) and Szurlies (2007). The correlation of the magnetostratigraphic pattern obtained with the GPTS was supported by cyclostratigraphy, derived from gamma-ray logs and the *Conchostraca* biostratigraphy. The Buntsandstein magnetostratigraphic charts of the German and Polish parts of the CEB differ only in the number of thin magnetozones. In the German scheme (Szurlies *et al.*, 2003; Szurlies, 2007), the extensive normal-polarity zone, characteristic for the upper part of Middle Buntsandstein, is interrupted by thinner reversed-polarity zones, subzones and events than had been observed in Poland (Nawrocki, 1997). The astronomically calibrated magnetostratigraphic scheme from Germany was correlated with several Chinese sections (Li *et al.*, 2016); however, this correlation is inconsistent with the U-Pb isotope ages (Galfetti *et al.*, 2007; Hounslow, 2017).

Becker and Nawrocki (2014) and Becker *et al.* (2020) established a more precise integration between magnetostratigraphy and palynostratigraphy for the western and north-eastern regions of the Polish part of CEB respectively. The possibility of occurrence of short reversals within the Tbn1 zone of Nawrocki (1997), similar those shown by Szurlies (2007) for parts of the German basin, was confirmed (Becker and Nawrocki, 2014). The chronostratigraphic Permian/Triassic boundary is very close to the base of the Tbn1 magnetozone (see Hounslow and Muttoni, 2010). Becker *et al.* (2020) postulated, that the base of the Tbn6-Tbn7 normal magnetozone interval is a good marker horizon throughout the basin. A precise correlation of short reversed zones or subzones, detected within this long normal interval, could not be provided for the sections from different parts of the basin.

The aim of this study is to present new magnetostratigraphic data from the Middle Buntsandstein section, drilled in the Brześć Kujawski IG-1 borehole (Kuyavian-Pomeranian Voivodeship, Central Poland), located in one of the subsidence centres of the CEB (Fig. 1A). The magnetic polarity chart defined for these deposits is correlated with existing magnetostratigraphic schemes from other sites of the CEB and finally, the chronostratigraphic position of particular formations of the Buntsandstein is discussed.

GEOLOGICAL SETTING

The Buntsandstein Group in the Polish part of the CEB consists of four formations (from bottom to top): Baltic, Pomerania, Połczyn and Röt. The lateral equivalent of the carbonate-sulphate Röt Formation of southern Poland is the clastic Barwice Formation, developed in the north-western part of the Polish subbasin. This lithostratigraphic subdivision is typical for the western, main part of the Polish subbasin. The Baltic Formation constitutes the Lower Buntsandstein, the Pomerania and Połczyn formations belong to the Middle Buntsandstein, and Röt (Barwice) Formation represents the Upper Buntsandstein. A feature of the thickness pattern of the Polish Buntsandstein is a NW-SE-oriented basinal structure (the Mid-Polish Trough), where the thickness of the group is greatest, reaching more

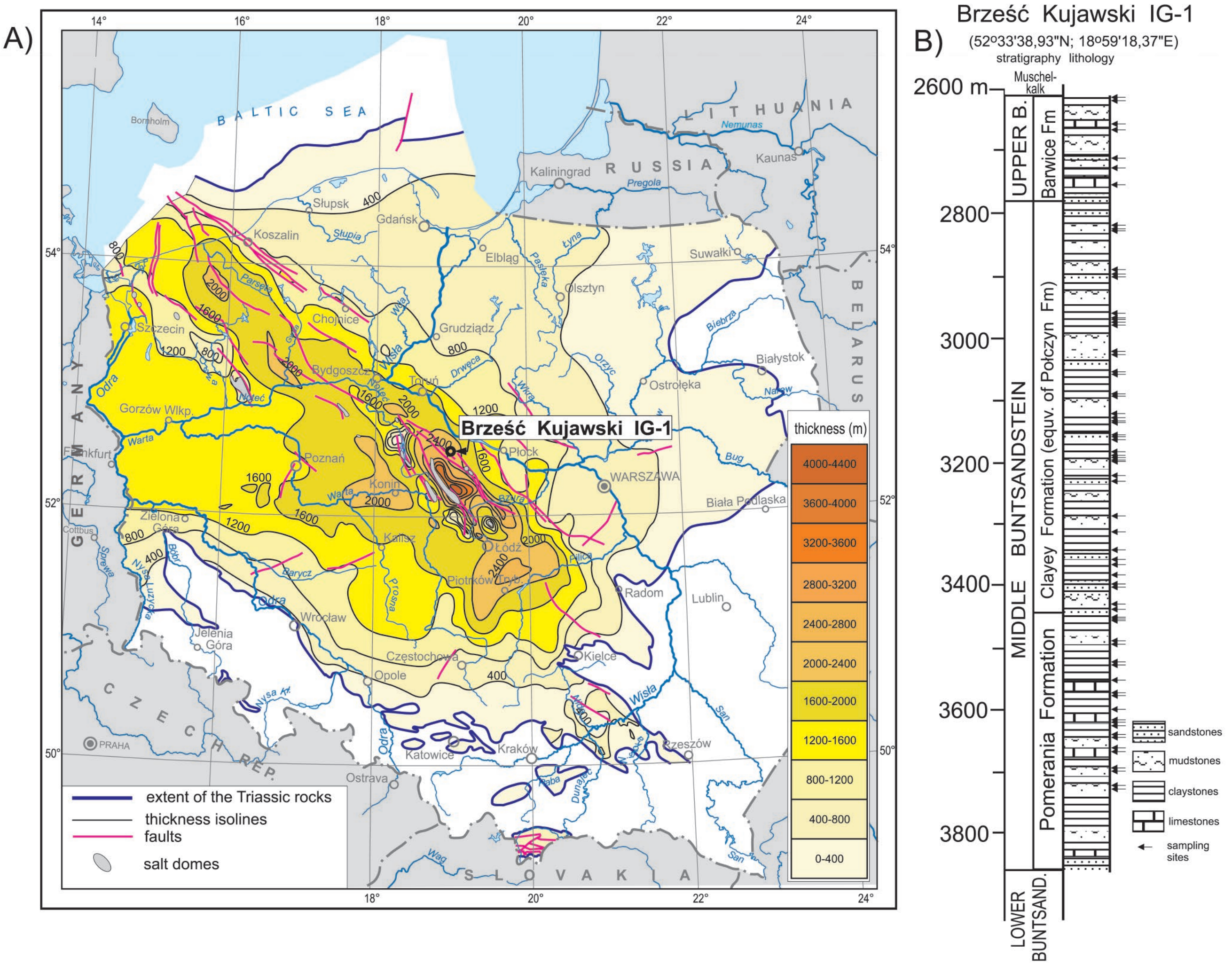

Fig. 1. Geological setting and paleomagnetic sampling. **A.** Location of the Brześć Kujawski IG-1 borehole on the thickness map of the Triassic in Poland (Becker and Szulc, 2020). **B.** Stratigraphy and lithology of Middle and Upper Buntsandstein sequence in the Brześć Kujawski IG-1 borehole (after Szyperko-Teller and Szulc, 2008 and Feldman-Olszewska, 2008). Sites of palaeomagnetic sampling also are shown.

than 1,800 m (Bachmann *et al.*, 2010). The greatest thickness variations are characteristic for the Middle Buntsandstein (Szyperko-Teller and Moryc, 1988).

The borehole Brześć Kujawski IG-1 is located in the central part of the Mid-Polish Trough. There, the Buntsandstein is 1,646 m thick, of which 387 m represent the Lower Buntsandstein, 1,085.5 m – the Middle Buntsandstein and 173.5 m – the Upper Buntsandstein (Feldman-Olszewska, 2008).

MATERIAL AND METHODS

Seventy pieces of drill core were taken from the Brześć Kujawski IG-1 vertical borehole at depths between 2660–3725 m. Samples were taken primarily from the red and brown sandstones and mudstones of the Middle and Upper Buntsandstein (Fig. 1B). Some of them also were extracted from the intercalations of grey mudstones and limestones of this age range. All samples were oriented up only (i.e., no azimuthal orientation). Each fragment of drill core was cut into cylindrical specimens, one inch in diameter. The natural remanent magnetization (NRM) was measured using JR-5 spinner magnetometers (AGICO, Brno). All samples were subjected to a stepwise thermal demagnetization in the non-magnetic MMTD1 furnace (Magnetic Measurements Ltd). The NRM measurements and demagnetizations were carried out in a MMLFC shielded room of Magnetic Measurements Ltd. The demagnetization results were analysed using orthogonal vector plots (Zijderveld, 1967) and the directions of linear segments were calculated using principal component analysis (Kirschvink, 1980). The diagrams representing the results were drawn by means of a computer package, written by Lewandowski *et al.* (1997). Earlier investigations show that hematite is the most common ferric mineral in the Buntsandstein red beds of the CEB; however, magnetite is predominant in the grey mudstone and limestone intercalations (e.g., Nawrocki, 1997; Szurlies *et al.*, 2003).

RESULTS

Palaeomagnetic components

The NRM intensities of specimens varied from 2.3 x 10^{-3} A/m do 4.2 x 10^{-2} A/m. During stepwise thermal demagnetization, rocks from 43 pieces of bore core (61% of sample set) revealed the presence of an NRM component with a relatively shallow inclination that can be correlated with the Early Triassic magnetization in this part of Europe (see e.g., Torsvik *et al.*, 2012). In most of the specimens, this NRM component was removed at temperatures higher than 600 °C (Fig. 2, samples b19a, b32a) for those specimens cut from red and brown sandstones and mudstones. This supports previous data that hematite is the main carrier of the Triassic component of NRM in the red and brown beds of the CEB (Nawrocki, 1997). Almost all specimens with such a high-temperature Triassic component also contained a component with a steep inclination, which was demagnetized at ca. 550 ^{o}C. Some (39%) of the studied specimens revealed the presence of this component. In these specimens, the steep inclination was preserved up to the end of the demagnetization experiments indicating their total remagnetization (Fig. 2, samples b6a, b37a). The inclination of the steep component at ca. 60–70° corresponds to the expected Brunhes component of the area studied, as can be inferred from the reference Apparent Polar Wander Path (Torsvik *et al.*, 2012). The nature of this recent component can be viscous or/and chemical when its unblocking temperatures are high. It should be stressed that in some samples an additional component recently acquired with a vertical inclination is also observed (Fig. 2, samples b6a, B37a). This component most probably was induced during drilling. A few specimens of grey limestones and mudstones were not remagnetized totally, indicating at temperatures 450–500 °C a component with an inclination of close to 30°, most probably of Triassic age. Some of the core pieces were upside down in the core boxes, but these samples were easily identified as the low-temperature component displayed a steep negative inclination (Fig. 2, samples b39a, b53a). Since the samples were not geographically oriented, the characteristic Triassic directions isolated from the rocks are spread around a small circle (Fig. 3) with a mean value of inclination of 32 ±4°.

Magnetic polarities

Despite gaps arising from total remagnetization of part of the sample set and a limited density of sampling, the magnetic polarity record of the uppermost part of the Pomerania Formation and the Clayey Formation (equivalent of the Połczyn Formation) is relatively continuous and consistent. In the Upper Buntsandstein part of the studied section, only two samples provided credible magnetic polarity (Fig. 4).

In the Pomerania Formation, a reversed polarity record is predominant. Two thin normal-polarity zones were also detected. The Clayey Formation revealed the presence of a normal-polarity record with only one reversed-polarity sample. The reversed polarity record noted in the Pomeranian Formation changes to the normal polarity magnetization, typical for the Clayey Formation, at 3403–3438 m of depth.

DISCUSSION

Magnetostratigraphic correlation of rocks studied with other sections of the Buntsandstein in Poland

The magnetic polarity pattern within the Middle Buntsandstein sequence was studied previously in the Otyń IG-1, Kołobrzeg IG-1, Połczyn IG-1 (Nawrocki, 1997), Gorzów Wielkopolski IG-1 (Becker and Nawrocki, 2014), Bartoszyce IG-1 and Nidzica IG-1 (Becker *et al.*, 2020) boreholes. The data obtained from the Brześć Kujawski IG-1 borehole correspond well with the results from these boreholes (Fig. 5). Mainly a reversed-polarity record interrupted by two normal-polarity magnetozones, is characteristic for the Pomerania Formation. The lowermost part of the Clayey Formation (equivalent of the Połczyn Formation) is of reversed polarity and deposits from its middle and upper part contain a record of a normal-polarity geomagnetic field. It was disturbed only once, by a single, narrow reversed-po-

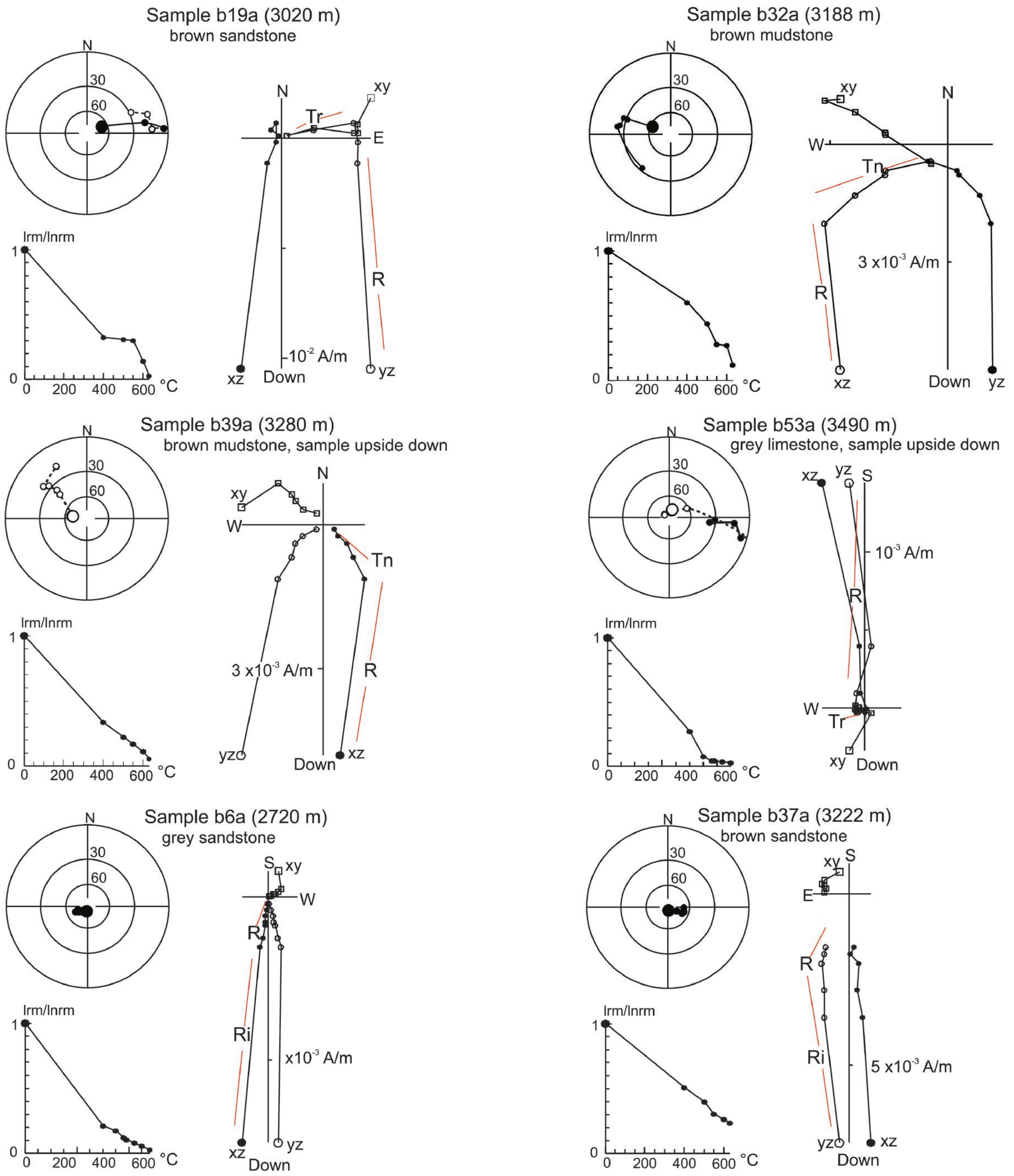

Fig. 2. Results of thermal demagnetization of selected specimens from the Brześć Kujawski IG-1 borehole. For each sample a stereographic projection of the demagnetization path (upper left), an intensity decay curve (lower left) and an orthogonal plot (right) are shown. Inrm – initial intensity of natural remanent magnetization, Irm – intensity of remanent magnetization after thermal demagnetization. Particular components of magnetization are marked on orthogonal plots (Tr – Triassic component of reversed polarity, Tn – Triassic component of normal polarity, R – component reflecting recent remagnetization, Ri – component induced by drilling).

larity interval. The magnetic polarity indicates that the base of the Połczyn Formation is either diachronous, or that part of the Połczyn Formation is missing in the Brześć Kujawski IG-1 well. The lowermost part of Połczyn Formation seems closer to being complete in the Połczyn IG-1 borehole, where a reversed-polarity zone ca. 110 m thick was defined in contrast to the Brześć Kujawski IG-1 borehole, which had no more than 25 m of reversed-polarity record at its base. At least five additional, thin reversed-polarity zones were distinguished by Szurlies (2007) in the upper part of the Middle Buntsandstein (the Hardegsen and Solling formations) of the German part of the CEB. This difference between magnetic polarity patterns, obtained for the upper part of the Middle Buntsandstein, may result from a higher density of sampling in the German part of the CEB, or that their characteristic magnetization was not of a primary nature in some parts of the borehole studied. Despite extensive palaeomagnetic studies of the Buntsandstein rocks, the primary (i.e., coeval with sedimentation) origin of the acquisition of magnetic remanence has not been sufficiently documented.

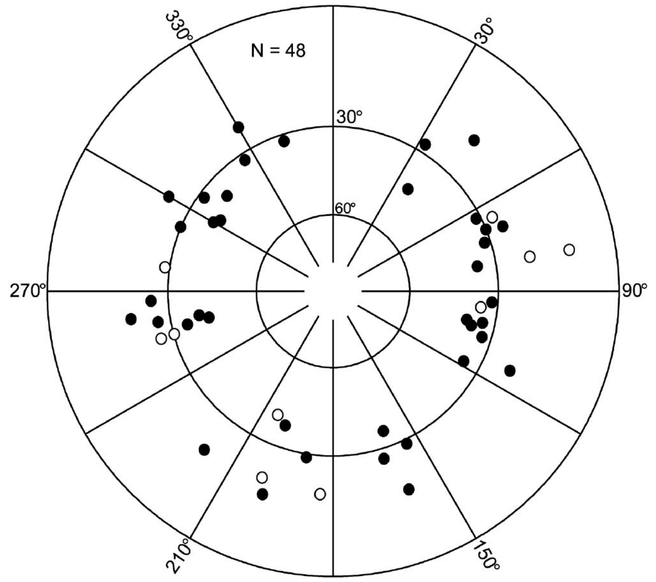

Fig. 3. Stereographic projection of the early Triassic characteristic directions isolated from the Buntsandstein deposits in the Brześć Kujawski IG-1 borehole. The declination dispersion is what would be expected for unoriented core.

The Buntsandstein formations in the framework of the Lower Triassic chronostratigraphic units

The magnetostratigraphic correlation between particular Buntsandstein formations of the CEB and the Lower Triassic chronostratigraphic units can be performed because the reference magnetic polarity pattern was developed in the basins with key biostratigraphic markers. However, the reference scheme has been upgraded and changed substantially during the last 30 years and because of this the chronostratigraphic positions of particular Buntsanstein formations had to be modified (see Nawrocki, 1997; Szurlies *et al.,* 2003; Szurlies, 2007; Hounslow and Muttoni, 2010). The regional correlation was supported by palynostratigraphy (Nawrocki, 1997; Becker *et al.*, 2020) and *Conchostraca* biostratigraphy (Szurlies *et al.*, 2003; Szurlies, 2007). As a tool of regional and global correlation of particular Buntsandstein formations, cyclostratigraphy was applied as well (Szurlies *et al.*, 2007; Li *et al.*, 2016).

The magnetic polarity record indicates that the Baltic Formation is of Induan age (Figs 5, 6), with its uppermost part revealing the presence of magnetozones Tbn3 and Tbr3 belonging to the Dienerian (Fig. 6; Nawrocki, 1997; Hounslow and Muttoni, 2010). The Induan/Olenekian boundary is close to the boundary between the Tbr3 and Tbn4 magnetozones. This correlation is in agreement with palynological data, indicating the location of the Induan/Olenekian boundary in the lower part of the Pomerania Formation in Poland and that of the Volpriehausen Formation in Germany (Figs 6, 7; Orłowska-Zwolińska, 1984, 1985; Kürschner and Herngreen, 2010; Nowak *et al.*, 2018).

There is a significant discrepancy in chronostratigraphic correlation of the upper (i.e., younger than Induan) part of the Middle Buntsandstein and the Upper Buntsandstein, where normal polarity predominates. Five (Nawrocki, 1997) or even nine (Szurlies, 2007) reversed -polarity zones occur in this part of the Buntsandstein section. It is obvious that magnetostratigraphy alone is insufficient for any chronostratigraphic correlation of this part of the Buntsandstein group. Unfortunately, the *Conchostraca* and palynological biostratigraphy are inconsistent in this part of the Triassic. Moreover, palynological results alone have been interpreted

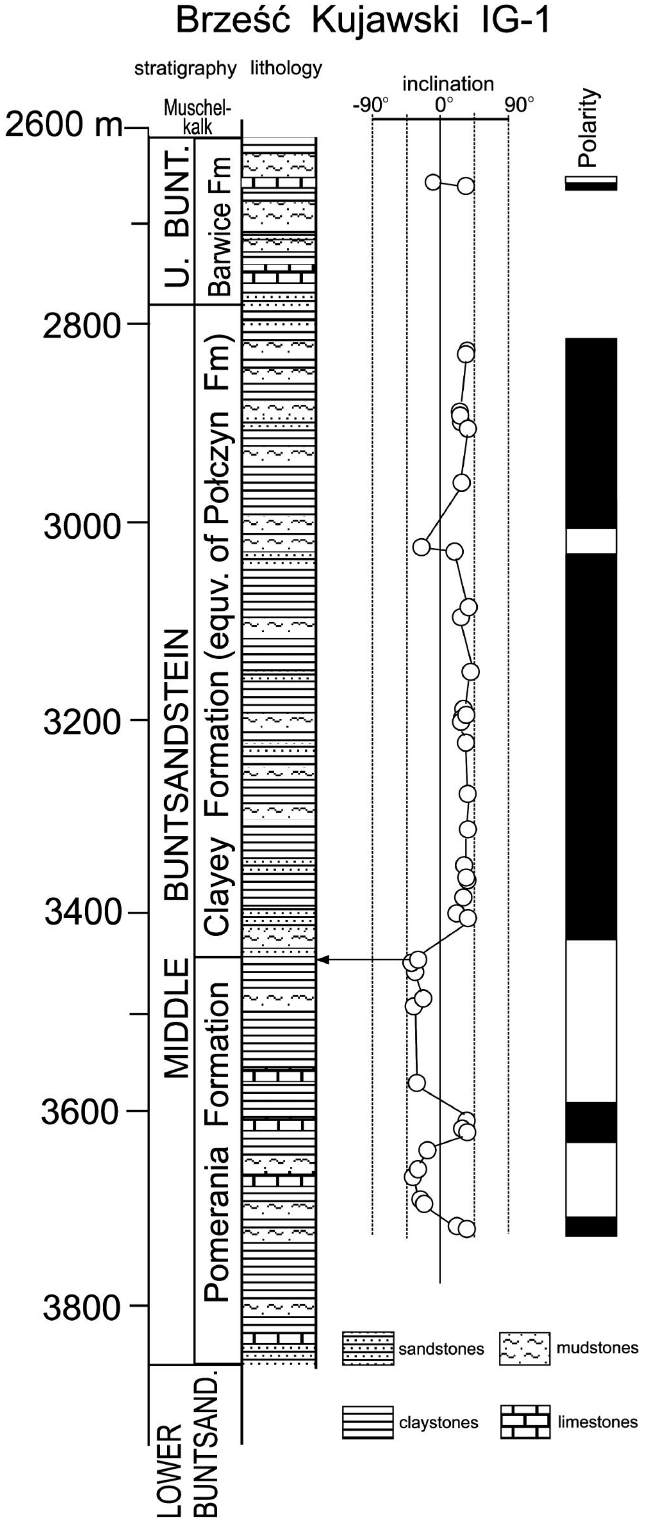

Fig. 4. Characteristic inclinations and magnetic polarities recorded in the Middle and Upper Buntsandstein deposits from the Brześć Kujawski IG-1 borehole.

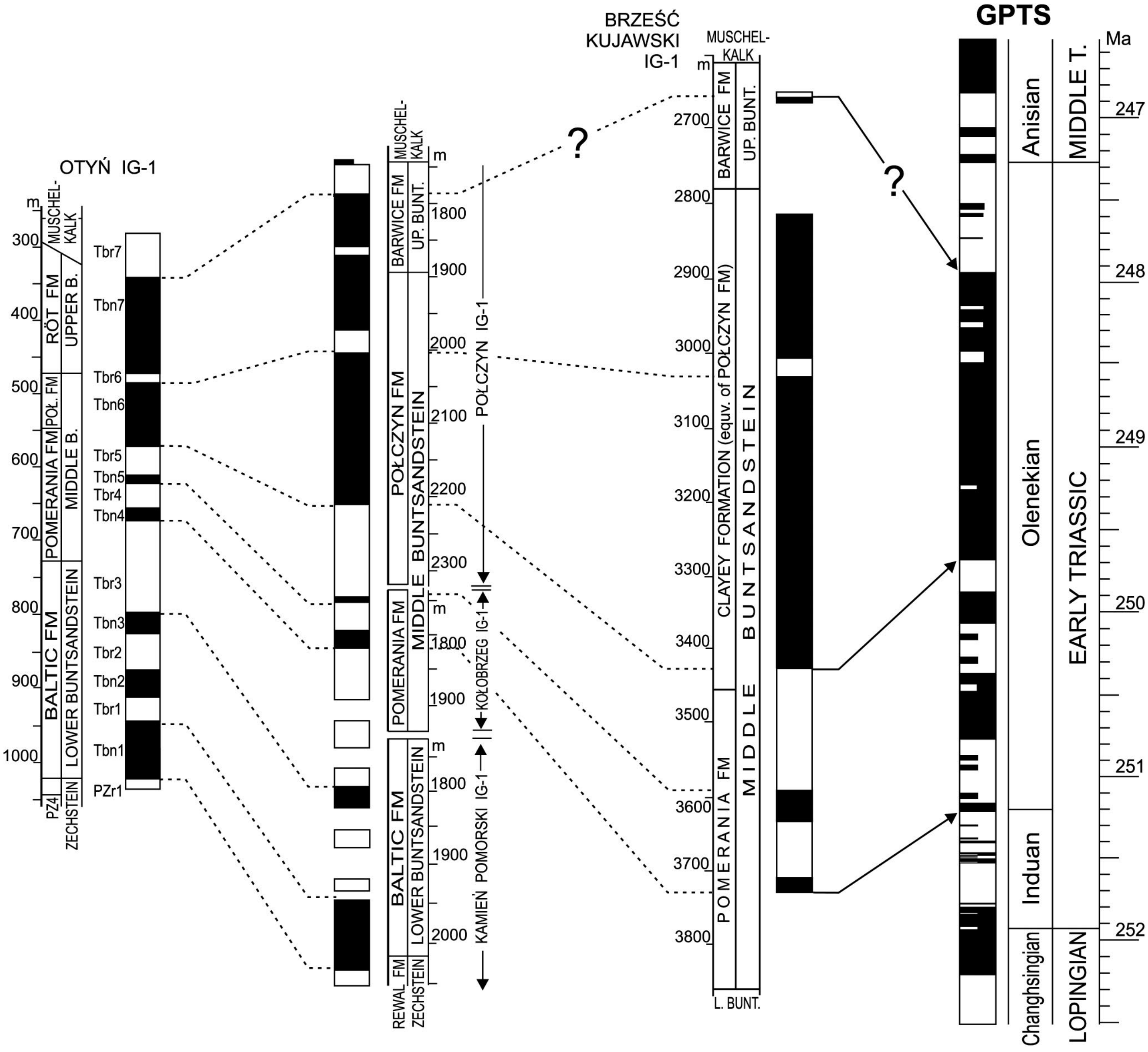

Fig. 5. Magnetostratigraphic correlation of the magnetic polarity column obtained for the Brześć Kujawski IG-1 borehole with other palaeomagnetically studied Buntsandstein sections from the Polish Basin (Nawrocki, 1997) and with the reference Triassic geomagnetic polarity timescale (GPTS with subzones, from Maron *et al.* (2019), modified after Cohen *et al.* (2013; updated). Lithostratigraphy after: Senkowiczowa and Gajewska in Orłowska-Zwolińska (1977) for Otyń IG-1, Szyperko-Teller and Szulc (2008) and Feldman-Olszewska (2008) for Brześć Kujawski IG-1, Szyperko-Teller (1982, 1987) for Kamień Pomorski IG-1, Kołobrzeg IG-1 and Połczyn IG-1.

in different ways. Accordingly, almost the whole Upper Buntsandstein was correlated either with the upper Spathian (Nawrocki and Szulc, 2000), or with the lower Anisian (Nawrocki, 1997; Szurlies, 2007; Hounslow and Muttoni, 2010).

The occurrence of *Volziaceaesporites heteromorpha* Zone in the entire Upper Buntsandstein section in the Polish part of the CEB indicates that the Olenkian/Anisian boundary should be located somewhere in the upper part of the Upper Buntsandstein (Fig. 7; Orłowska-Zwolińska, 1977, 1984). In the German part of the CEB, the boundary is linked to the GTr6/GTr7 palynozones and is located in the bottom part of the Upper Buntsandstein (Fig. 8; Heunisch, 1999; Kürschner and Herngreen, 2010; Backhaus *et al.*, 2013). This discrepancy could document a distinct diachroneity of the Upper Buntsandstein within the CEB; however, the reason is most likely of an interpretative nature. Orłowska-Zwolińska (1984, 1985) and Reitz (1988) provided chronostratigraphic interpretation of their palynostratigraphic results from Poland and Germany, respectively. Unfortunately, both authors used different sets of reference sections for their interpretations. Orłowska-Zwolińska (1984, 1985) based her conclusions on the data provided from Arctic Canada (Fisher, 1979 in Orłowska-Zwolińska, 1984, 1985), the Alps (Visscher and Brügman, 1981 in Orłowska-Zwolińska, 1984, 1985) and Hessen in Germany (Doubinger and Bühmann, 1981 in Orłowska-Zwolińska, 1984, 1985). On the other hand, Reitz (1988) correlated

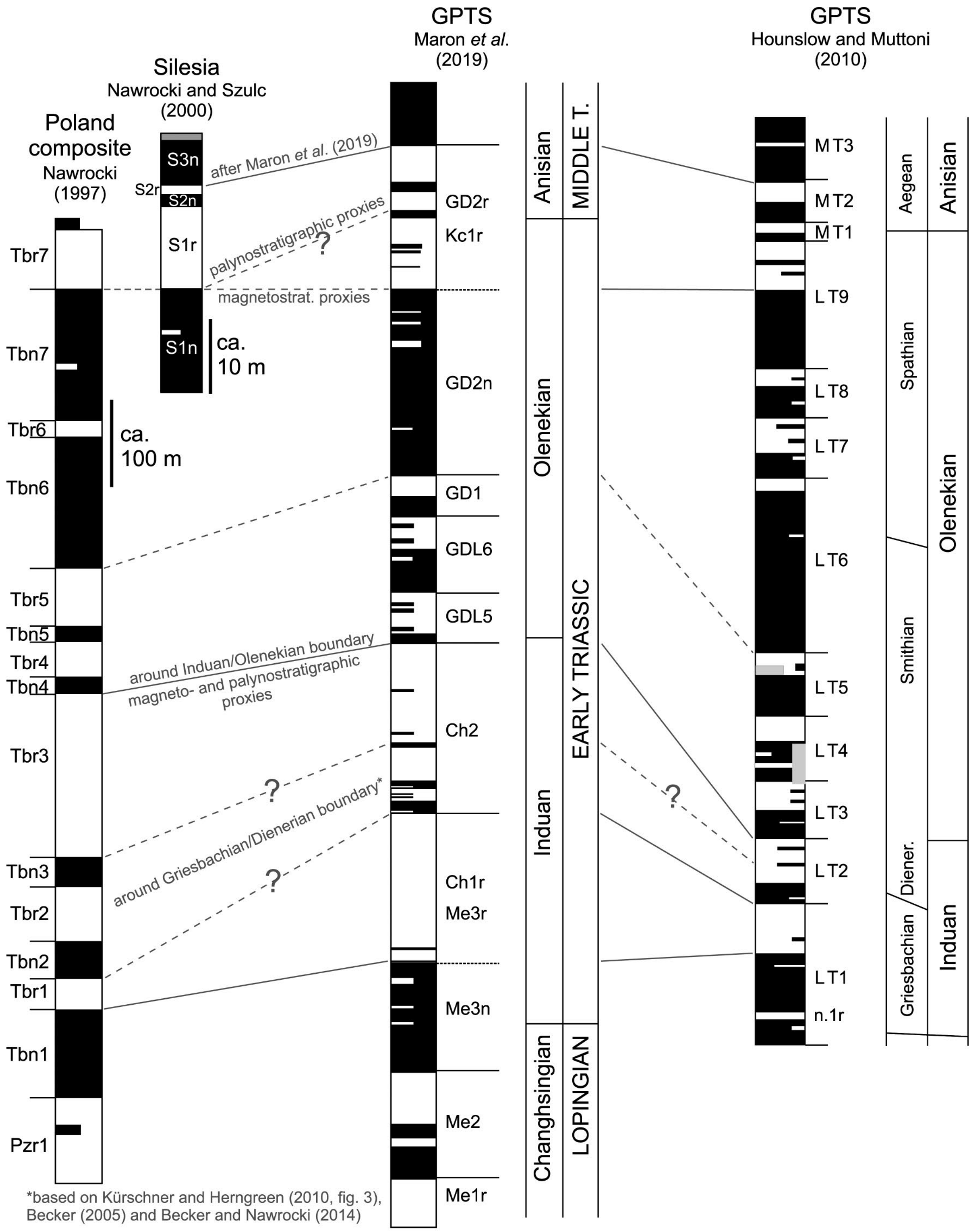

Fig. 6. Correlation of composite palaeomagnetic scale for the Polish Buntsandstein (after Nawrocki, 1997) and the Upper Buntsandstein to lowermost Muschelkalk magnetostratigraphy from southern Poland (Silesia, after Nawrocki and Szulc, 2000) with the geomagnetic polarity timescale (GPTS) of Maron *et al.* (2019, with subzones) and the earlier GPTS of Hounslow and Muttoni (2010). Additional information on correlation proxies and references are marked on the figure. Solid lines denote the most probable correlations.

his results mostly with data from the Alps (Visscher and Brügman, 1981 in Reitz, 1988) and partly from Romania (Antonescu *et al.*, 1976 in Reitz, 1988), omitting the data from Arctic Canada altogether. The authors came to different conclusions: Orłowska-Zwolińska (1984, 1985) postulated an Olenekian to Anisian age of the *Volziaceaesporites heteromorpha* assemblage, whereas Reitz (1988) gave an Anisian age for all the equivalent palynological assemblages. Orłowska-Zwolińska (1984, 1985) postulated an Anisian age for the upper part of the *V. heteromorpha* Zone, discussed as an informal *Microcachryidites fastidiosus* Subzone (Fig. 7). The possibility cannot be excluded that using the criteria proposed by Orłowska-Zwolińska (1984, 1985), the Anisian age within the Buntsandstein succession

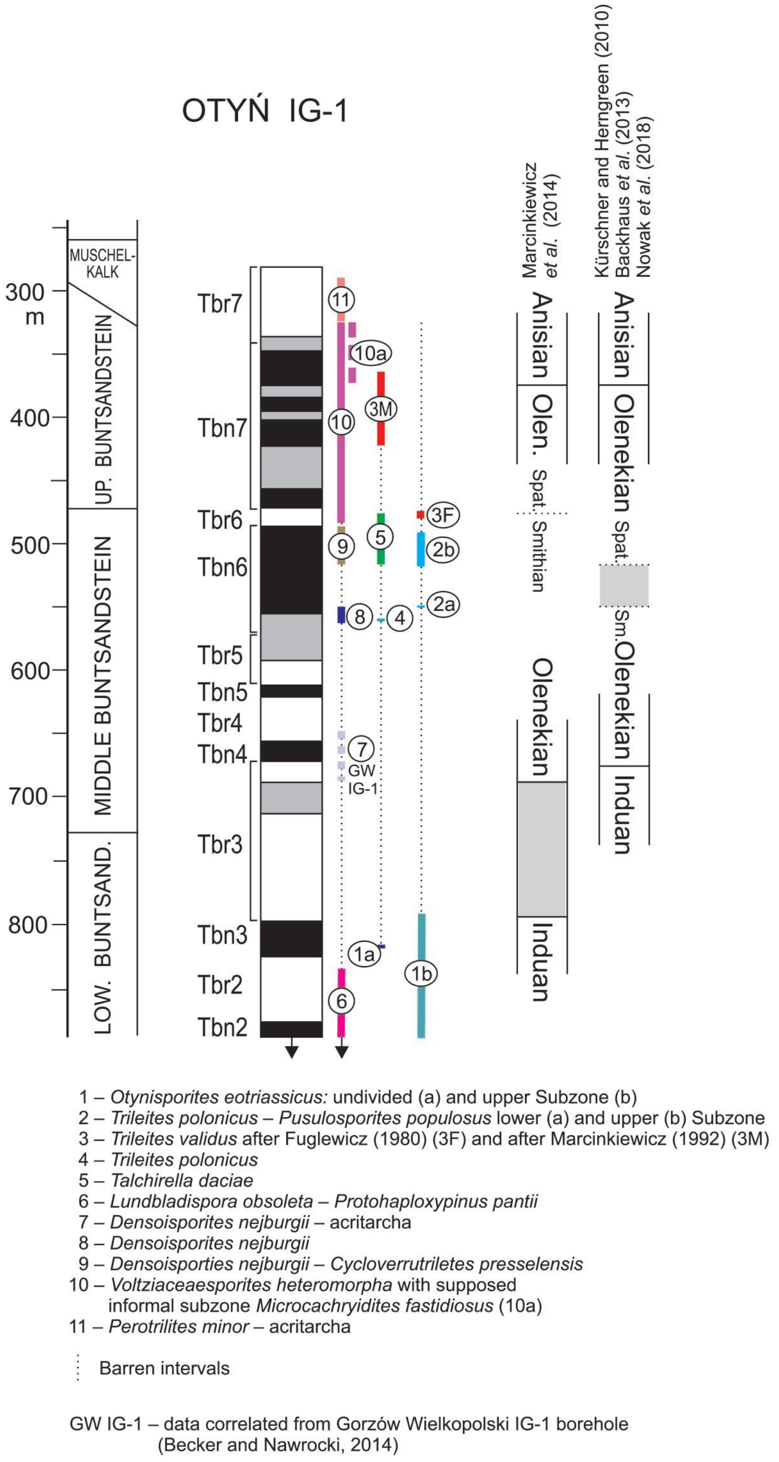

Fig. 7. Reference section of Otyń IG-1 for the Middle and Upper Buntsandstein magnetostratigraphy and palynostratigraphy in the Polish part of the Central European Basin with recent chronostratigraphic interpretation based on palynologic research. References for the biostratigraphy: 1b, 2, 3F – Fuglewicz (1980); 1a, 3M, 4, 5 – Marcinkiewicz (1992); 6, 7, 8, 9, 10, 11 – Orłowska-Zwolińska (1984); 10a – Orłowska-Zwolińska (1984, 1985). Spat. – Spathian. Lithostratigraphy after Orłowska-Zwolińska (1984) and Nawrocki (1997).

could be assigned to the palynological assemblages defined by Reitz (1988) in the uppermost Upper Buntsandstein only. The Olenekian/Anisian boundary would then correspond to the uppermost GTr7 zone of Heunisch (1999) and Backhaus *et al.* (2013), rather than to the boundary of the GTr6/GTr7 zones. Both Orłowska-Zwolińska (1984, 1985) and Reitz (1988) stressed that the problem of the location of the Anisian base remains open, despite their conclusions and, in fact, both boundaries have no stratigraphic definition up to now (Cohen *et al.*, 2013).

A global correlation of the Buntsandstein formations of the CEB with the Chinese coeval sections and the reference Global Polarity-Time Scale was performed using cyclostratigraphy as the main tool (Szurlies, 2007; Li *et al.*, 2016); however, such a correlation is only credible when significant basin-scale gaps are absent. The most probable regional gap in the Buntsandstein section of the CEB is connected to the Hardegsen Uncorformity, occurring at the base of the Solling Formation (Bachmann *et al.*, 2010). At least a part of the underlying Hardegsen Formation is missing on a basinwide scale (Röhling, 1991, 2013; Becker, 2005; Szurlies, 2007). In the Polish part of the CEB, this hiatus is located at the bottom of the Röt Formation or at the bottom of Świdwin Member of the Połczyn Formation (Szyperko-Śliwczyńska, 1979; Fuglewicz, 1979; Orłowska-Zwolińska, 1984; Nawrocki, 1997; Becker, 2005). The absence of the palynological *Densoisporites nejburgii-Cycloverrutrilletes presselensis* Subzone (Orłowska-Zwolińska, 1984) and the abrupt change of sedimentary environment from lagoonal to fluvial, noted in the Gorzów Wielkopolski IG-1 borehole (Becker, 2005, 2014; Feldman-Olszewska, 2014), support the hypothesis about the existence of this gap (Fig. 8). Another significant stratigraphic gap is related to the Detfurth Unconformity, located in the bottom part of the Detfurth Formation (e.g., Röling, 1991, 2013; Bachmann and Kozur, 2004). In the Polish part of the CEB, the gap is supposed to be within the Pomerania Formation (Becker, 2005, 2014); however, it is only constrained to the western part of Szczecin-Kalisz high (Becker, 2005). Despite the lack of the 10th cycle of the Volpriehausen Formation in the Brüggen Z1 and Bockenem A100 boreholes and having identified it in the Solling 5 borehole, Szurlies (2007) did not introduce the Detfurth Unconformity into his stratigraphic scheme. A possible missing interval in the magnetostratigraphic chart for the German part of the CEB, due to a stratigraphic gap between Lower and Middle Buntsandstein, is suggested by Hounslow (2017). Such a gap was documented previously by Röhling (1991, 2013). Menning and Käding (2013), and Tietze and Röhling (2013) broadly discuss the gaps in the Buntsandstein section in Germany, confirming the complexity of the cyclicity observed and its interpretation. Despite the above constraints, Li *et al.* (2016) assumed a continuous stratigraphy and correlated the cycle-scaled magnetostratigraphy of the Buntsandstein section from the German part of the CEB with the cycle-based composite magnetic polarity reference scale. Most probably, cycles of different periods of eccentricity, or perhaps even eccentricity and obliquity cycles, were mixed in this correlation that provides the time calibration of the Lower Triassic chronostratigraphic boundaries, which is inconsistent with the results of radiometric dating (see Hounslow, 2017).

CONCLUSIONS

These relationships to previous magnetostratigraphic studies of the Buntsandstein formations of the CEB indicate the following:

The magnetostratigraphic pattern obtained from the Middle Buntsandstein rocks sampled in the Brześć Kujawski IG-1 borehole is the same as that obtained earlier in other boreholes from the Polish part of the CEB, despite the substantial thickness differences of the Middle and Upper Buntsandstein between the sections studied.

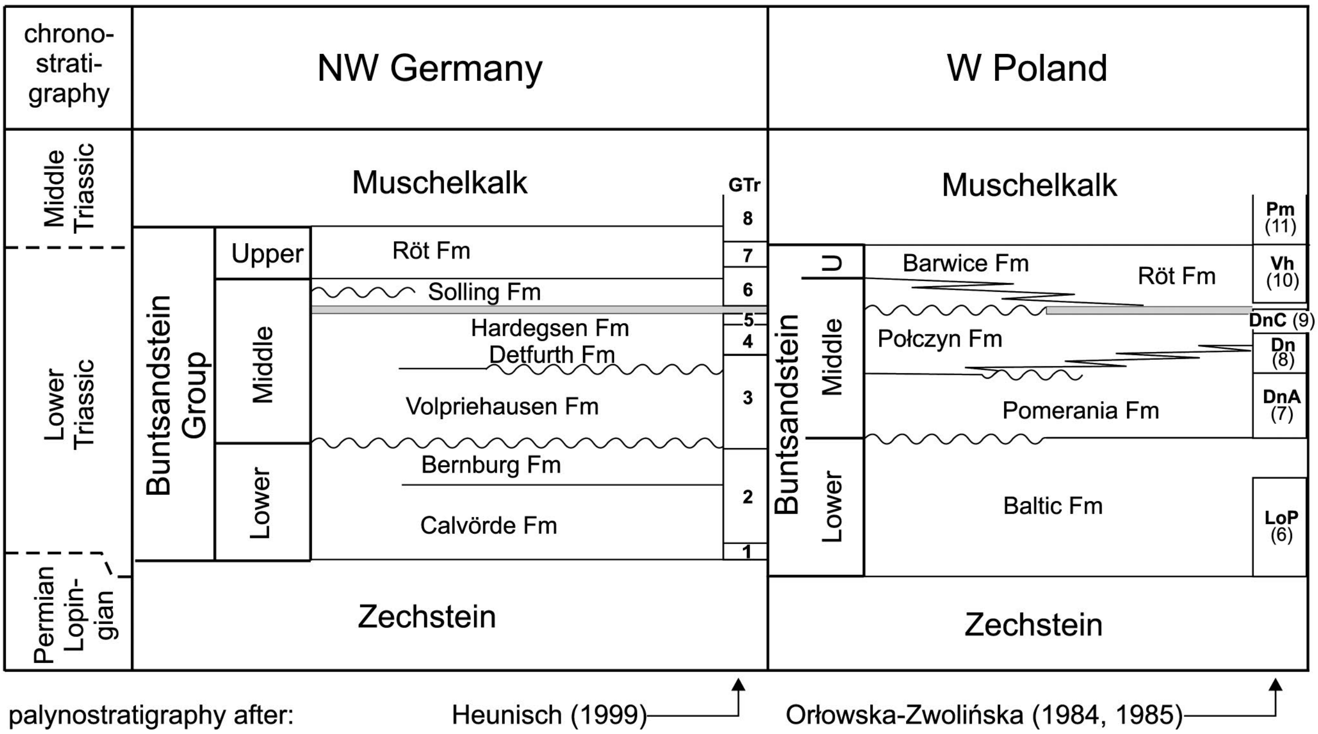

Fig. 8. Correlation of lithostratigraphic units with locations of the main discordances within the German and Polish parts of the Central European Basin (after Bachmann *et al.*, 2010, modified after Senkowiczowa, 1997; Szyperko-Teller, 1997; Becker, 2005; Becker *et al.*, 2020). German and Polish palynostratigraphic zones and subzones were located on the scheme according to their relationships to the German and Polish lithostratigraphic units, respectively (Orłowska-Zwolińska, 1985; Heunisch, 1999; Backhaus *et al.*, 2013). For the full names of the Polish zones, see Figure 7 with reference to the numbers in brackets.

In the Middle Buntsandstein sections from Poland, a thick normal-polarity magnetozone characterises the Połczyn Formation and is only interrupted by the one thin reversed-polarity zone. Evidently, thinner reversed-polarity magnetozones were distinguished in the coeval part of the Middle Buntsandstein studied in Germany. This discrepancy may result from a higher density of sampling in German part of the CEB. Another possible explanation of this difference is due to a certain delay in acquisition of the characteristic Triassic component of NRM.

Magnetostratigraphy and palynological evidence strongly indicate that the Induan/Olenekian boundary in the Polish part of the CEB is close to the boundary between the Tbr3 and Tbn4 magnetozones, which were defined in the lower part of Pomerania Formation.

Magnetostratigraphy alone is insufficiently clear in its definition of the Olenekian/Anisian boundary in the Buntsandstein section of the CEB. This boundary is most probably located within the upper part of the Upper Buntsandstein, as can be inferred from palynological studies in Poland and recent global palynological correlations.

It is difficult to support a continuous, cycle-based magnetic polarity scale of the Buntsandstein from the German part of the CEB and its full correlation with the composite global scale, when the sedimentary record in the Buntsandstein rocks studied is not continuous. Most probably, cycles of different Milankovich-frequencies were mixed, causing a correlation that provides the time calibration of the Lower Triassic chronostratigraphic boundaries to become inconsistent with the results of radiometric dating.

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