INTEGRATED MAGNETO– AND BIOSTRATIGRAPHY OF THE PIENINY LIMESTONE FORMATION, KRIŽNA UNIT, WESTERN TATRA MTS (POLAND).

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Abstract: The results of magneto- and biostratigraphic study of two Berriasian sections in the Križna unit of the Tatra Mts are presented. Magnetozones from CM18 up to CM16n were identified. Sedimentation rate varied from 8-10m/Ma in magnetozones CM17, CM17n and CM16, up to more than 22m/Ma in magnetozone CM16n.

Key words: Magnetostratigraphy, biostratigraphy, sedimentation rate, Berriasian, Tatra Mts

The Pieniny Limestone Formation in the Križna unit of the Tatra Mts (Lefeld et al. 1985) comprises grey pelagic calpionellid limestones and marlstones of the Tithonian – Upper Berriasian age (Pszczółkowski 1996). In the western part of the Tatra Mts it outcrops within a Bobrowiec sub-unit which constitutes relatively weakly deformed, northward dipping monocline (Bac 1971) with continuous Middle Triassic – Lower Cretaceous sequence.

Preliminary paleomagnetic study of the Bobrowiec sub-unit (Grabowski 2000) revealed that both normal and reversed polarity components occur within the Pieniny Limestone Formation; this indicates that primary magnetization was preserved. Our contribution aims to present more detailed magnetic stratigraphy of the upper (mostly Berriasian) part of the formation, supported by biostratigraphic analysis.

Two complementary sections, Pośrednie II and Dolina Lejowa, were sampled with portable gasoline powered drill. Sampling intervals were approximately 0.2 – 0.4 m. Standard cylindrical specimens for paleomagnetic investigations were prepared from the cores. Usually 2 – 4 specimens were obtained from each bed. Standard paleomagnetic procedure was applied including thermal and alternating field demagnetization, magnetic susceptibility, IRM (isothermal remanence magnetization) and magnetic hysteresis measurements.

Intensity of the natural remanent magnetization (NRM) varied between 1 and 6 x 10^{-4} A/m. Polarity pattern was distinct after thermal demagnetization up to 450 – 500^{o}C. Several normal and reversed polarity intervals were identified (Fig. 1). They were correlated with the

geomagnetic polarity time scale (GPTS) by means of calpionellid biostratigraphy using the scheme of Ogg et al. (1991). Magnetozones from CM18 up to CM16n were revealed (Fig. 2). The calculation of sedimentation rate, based on magnetozone age calibrating of Channell et al. (1995), was performed. The sedimentation rate varied from 8-10m/Ma in magnetozones CM17, CM17n and CM16, up to more than 22m/Ma in magnetozone CM16n. Within this magnetozone a gradual passage to the overlying Kościeliska Marl Formation (Lefeld et al. 1985) is observed. Higher sedimentation rate correlates with increased clay input into basin, which is also manifested by higher values of magnetic susceptibility (comp. Fig. 1a and 1b). Anomalously low sedimentation rate (only 3m/Ma) in magnetozone CM18n indicates that a gap (tectonic reduction?) might occur within the section. Hematite enrichment within this magnetozone is observed which contrasts with typical magnetite-based magnetic mineralogy through both sections.

Our results on the sedimentation rate of the Berriasian calpionellid limestones correspond well with data from the Osnica Formation of Strážovce section in Slovakia (Michalík et al., 1995, Table 1: 12.74m/Ma in the *Remaniella* subzone and 10.06m/Ma in the *C. elliptica* subzone).

Higher sedimentation rate in the Late Berriasian *Calpionellopsis* Standard Zone (CM16n) was accompanied by a decreased relative frequency of radiolarians from the lower part of the *Simplex* Subzone on. In the Dolina Lejowa section, radiolarians disappeared in the *Filipescui* Subzone and their paucity continued in the latest Berriasian-earliest Valanginian deposits of the Kościeliska Marl Formation. Probably, increased input of clay during Late Berriasian time was strongly unfavorable for the radiolarian assemblages, whereas calpionellids and calcareous Dinoflagellate cysts seem to be less affected by these new environmental conditions.

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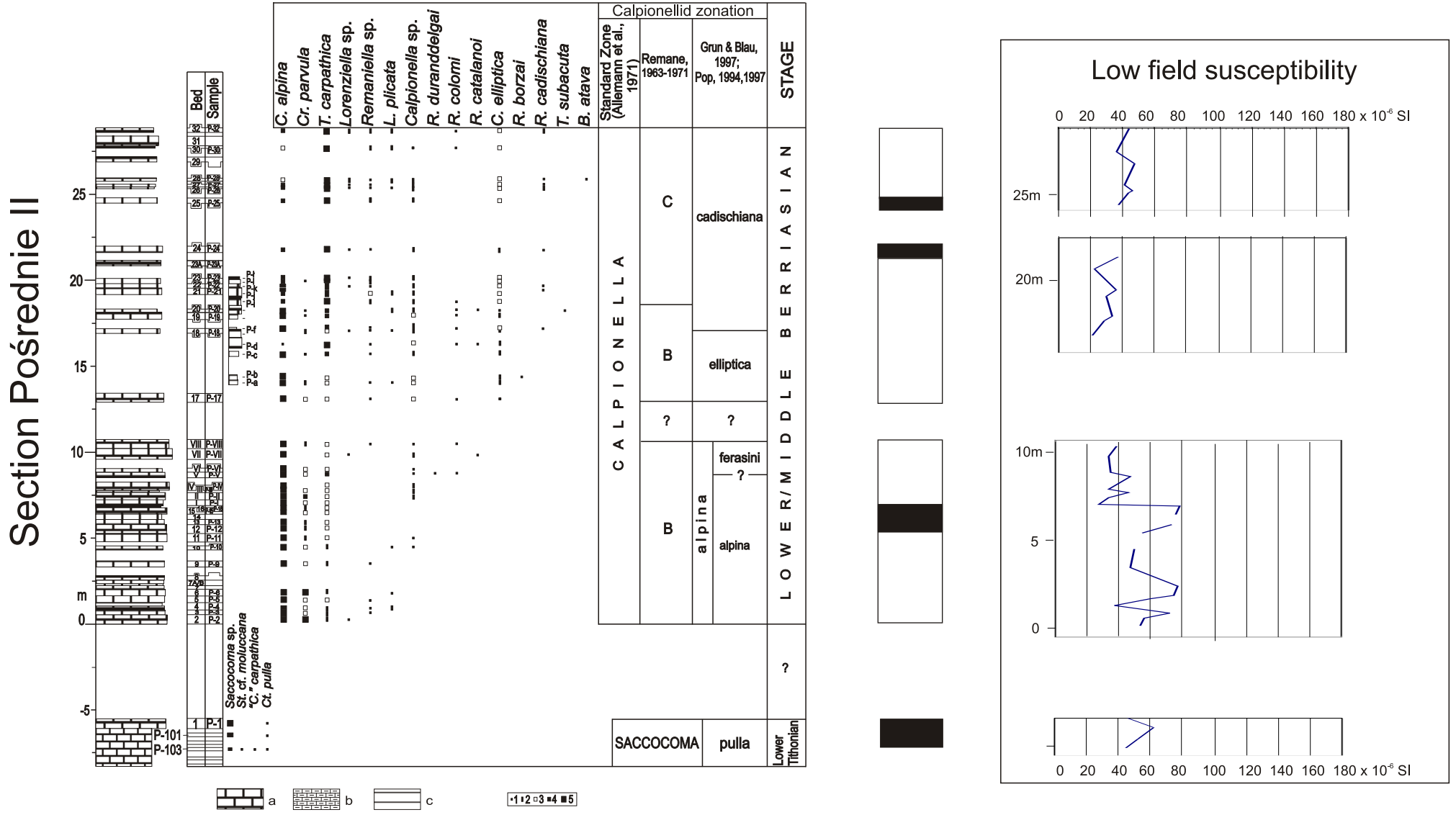
Fig. 1. Lithological, biostratigraphic, magnetostratigraphic and magnetic susceptibility data from the sections Pośrednie II (Fig. 1a) and Dolina Lejowa (Fig. 1b). Black – normal polarity, white – reversed polarity. Lithology: a – pelagic limestone, b – marly limestone, c – marl. Relative frequency of calpionellid taxa; 1 – rare (<1%), 2 – infrequent (1-5%), 3 – frequent (5 – 20%), 4 – common (20-40%), 5 – abundant (>40%).

Fig. 2. Composite Berriasian magneto- and biostratigraphic scheme of the studied sections and its correlation with GPTS.

Fig. 3. Estimation of sedimentation rate within studied Berriasian sections.



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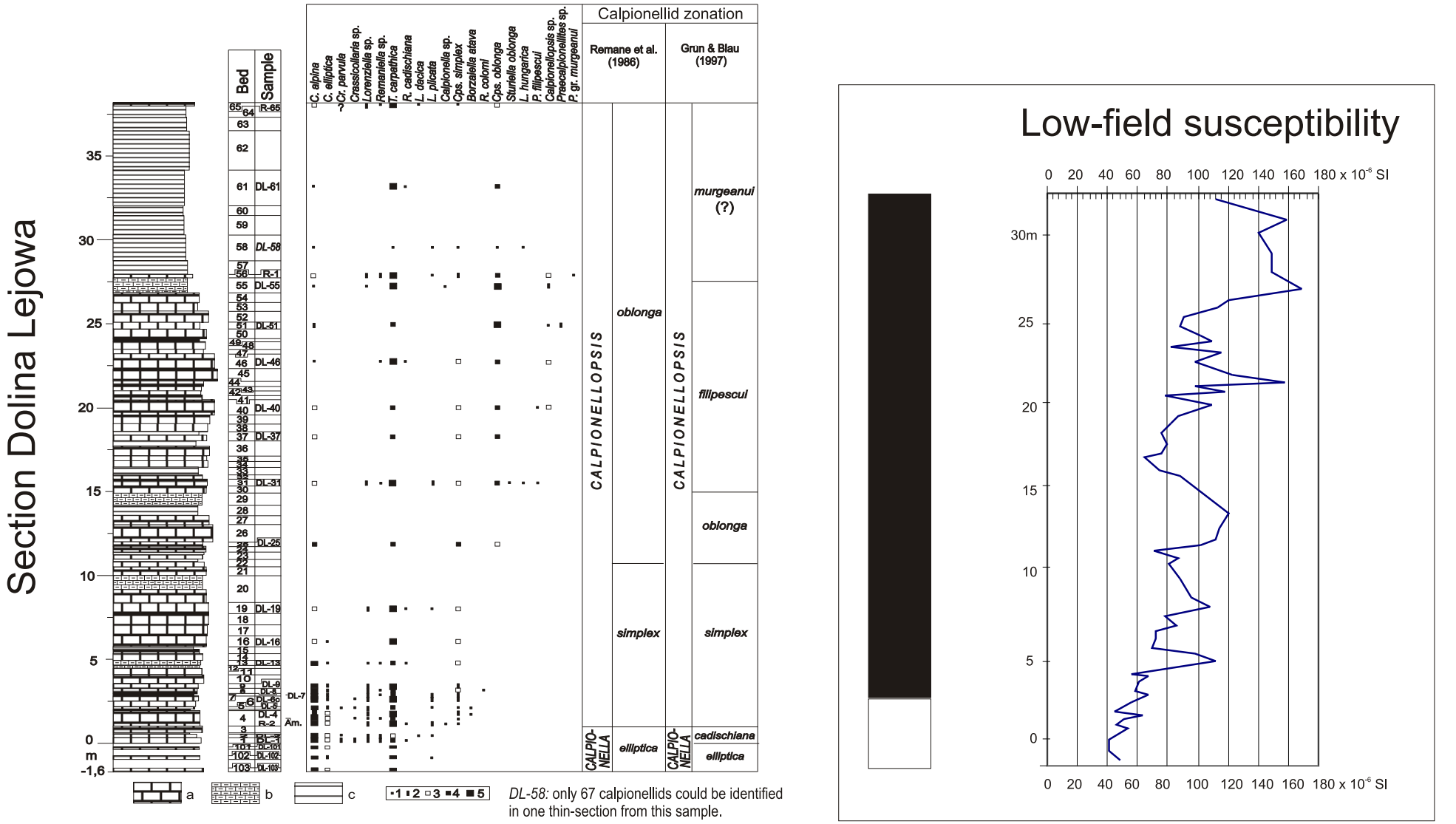
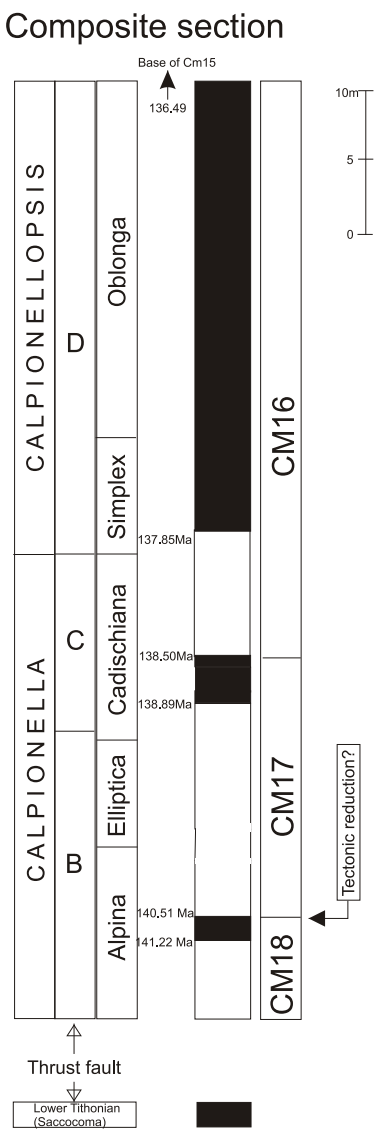

Section Dolina Lejowa
Bed
Sample
Calpionellid zonation
Remane et al. (1986)
Grun & Blau (1997)
C. alpina
C. elliptica
Cr. parvula
Crassicollaria sp.
Lorenziella sp.
Remaniella sp.
T. carpathica
R. cadischiana
L. decica
L. plicata
Calpionella sp.
Cps. simplex
Borzaiella slavа
R. colomi
Cps. oblonga
Sturiella oblonga
L. hungarica
P. filipescui
Calpionellopsis sp.
Praecalpionellites sp.
P. gr. murgeanui
CALPIONELLOPSIS
oblonga
simplex
CALPIONELLA
elliptica
murgeanui (?)
filipescui
oblonga
simplex
CALPIONELLOPSIS
CALPIONELLA
cadischiana
elliptica
DL-61
DL-58
R-1
DL-55
DL-51
DL-46
DL-40
DL-37
DL-31
DL-25
DL-19
DL-16
DL-13
DL-7
Äm.
R-2
35
30
25
20
15
10
5
0
m
-1,6
a
b
c
1 2 3 4 5
DL-58: only 67 calpionellids could be identified in one thin-section from this sample.

Low-field susceptibility
0 20 40 60 80 100 120 140 160 180 x 10-6 SI
30m
25
20
15
10
5
0
0 20 40 60 80 100 120 140 160 180 x 10-6 SI

Fig. 1b.



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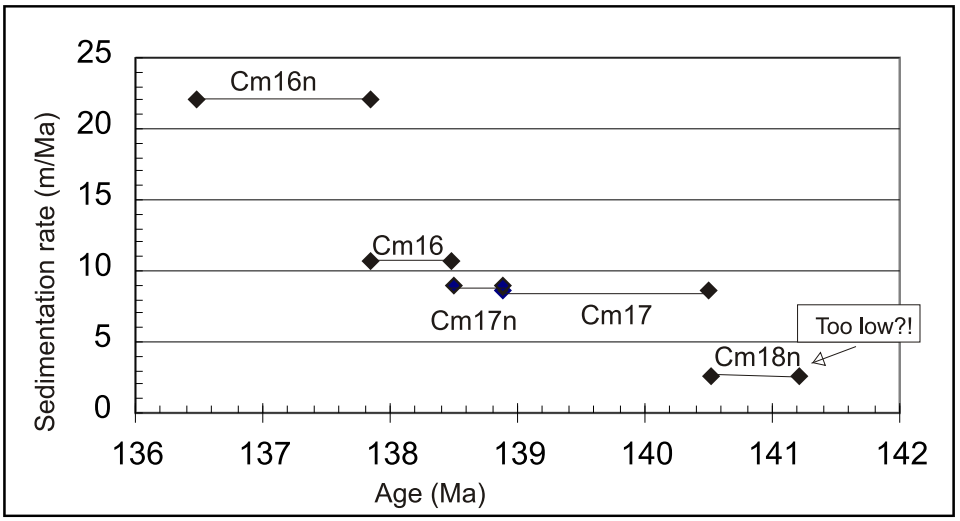

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