SEDIMENTOLOGY OF THE KYČERA BEDS (RAČA UNIT, MAGURA ZONE): FACIES, FLOW DYNAMICS AND DEPOSITIONAL ENVIRONMENTS

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Abstract: The Kýčera Beds are well exposed in the quarry between Klubina and Zborov nad Bystricou villages, NW Slovakia. Their sediments have been analysed and described in detail. Facies associations include mid- to outer fan sediments, deposited from a high density turbidity currents with minor contents of low-density turbidites. Interturbidite deposits consist of pelagic and hemipelagic basin plain facies. Except turbidity deposits there were also ascertained other gravity flow deposits and slumps.

Key words: Outer Western Carpathians, Rača Unit, Kýčera Beds, turbidites, facies

Introduction

The locality studied occurs in the NW part of the Outer Western Carpathians, about 15 km southeastward from Čadca town (Fig. 1c). Sandstone-dominated sequence on this locality belongs to the Kýčera Beds of the Rača Unit (Fig. 1d). Sedimentary analysis of the Kýčera Beds is based on the internal structures, stratification, bed-thickness distribution, paleocurrent orientation, etc. The primary data allow to interpret the facial associations, sedimentary sequences and depositional environments of the Kýčera Beds.

Sedimentary analysis

The Kýčera Beds consist mainly of sandstones with minor content of claystones. There were distinquished sedimentary facies (Fig. 1a), compared with deep-water facies after Pickering et al. (1986):

1. medium to thick-bedded sandstones (30 cm to 5 m) with normal gradation and medium to fine-sized fractionation. To the upper parts they are sometimes laminated and rippled.

Parallel lamination in the upper parts is marked by mica flakes and fossil plants. Mudstone intervals are reduced to thickness of about few mm or few cm. Flute marks are common. Amalgamation is frequent.

Interpretation:

The layers are characterised by well developed Ta Bouma intervals, decreasing in grain size upwards. This type of positive gradation is deposited by decelerated currents. Higher Bouma intervals (Tb – Te) are purely developed or they are sometimes eroded, cutting off by successive turbidity currents. This facies correspond to C2.1 facies after Pickering et al. (1986), deposited from a high-density turbidity currents.

2. medium to thick-bedded sandstones (30 cm to few m), exhibiting a positive gradation and coarse to medium-size fractionation. They contains dispersed mudstone intraclasts. The clast size (0.3 – 0.5 cm) and their percentual contents decresing to the upper parts of sandstone beds. Sometimes they form an intraclast "tracers" (0,5 to 2 cm), concentrated in the basal intervals of sandstone beds. Like the facies 1, they have purely developed parallel lamination and ripples to the upper bed divisions. Amalgamation and flute marks are frequent.

Interpretation:

Massive sandstone beds with positive gradation, raffted clasts and top-missing intervals correspond to A2.7 to A2.8 facies after Pickering et al. (1986), deposited from a high-density turbidites and sandy debris flows.

3. thin to medium layers (< 30 cm) consit of parallel laminated and rippled fine grained grey sandstones. They are often convolute deformed.

Interpretation:

They correspond to C2.2 and C2.3 facies after Pickering et al. (1986) deposited by low-density turbidity currents.

4. thin to medium-bedded sandstones (few cm to about 30 cm), alternated with predominantly thicker layers (to about 50 cm) of mudstones. Sandstones are grey and dark grey. They are massive, parallel laminated or rippled. Claystones are grey, dark, green, redish-brown.

Interpretation:

They correspond to D and E facies after Pickering et al. (1986). They are deposited by low-density turbidites or laminar flows. The layers consist of variegated claystones correspond to G

pelagic and hemipelagic facies after Pickering et al (1986). They were deposited in periods between activity of turbidity currents.

5. a pack of deformed layers consists of dark and brown claystones alternate with mainly thin layers consist of fine grained sandstones or siltstones. There are relatively undeformed layers under and above this about 400 cm thick pack of deformed layers.

Interpretation:

The pack of deformed layers correspond to F facies after Pickering et al. (1986), and they probably represent a submarine slump body.

Due to tectonic overprint a groups of the sedimentary layers from the 1st and 2nd ettage of the Klubina quarry do not interact together or they are slided together. Shearing of the sedimentary sequences complicated their description.

Conclusions

The Kýčera Beds include mid- to outer fan sediments, deposited predominantly from high-density turbidite currents, sandy debris flows, dilute turbidites and laminar flows. Turbidite sequences of submarine fans in the Kýčera Beds show a different stacking patterns. Thinning-upward sequences indicate inner channelized fan distributary systems of submarine fans. Thickening-upward sequences represent a progradational lobe units or compensational cycles (Fig. 1b). Mudstone dominant sequence with starved ripples and slumps recalls the levee or interchannel deposits. Pelagic and hemipelagic basin plain facies associations were deposited in periods between turbidity currents activity. Except turbidity deposits there was also ascertained other gravity flow deposits and slump bodies. Sequential development of the Kýčera Beds records the morphological and gradient changes of submarine fans, alternating in channel, lobe, levee and interchannel systems (cf. Starek & Pivko 2001).

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References

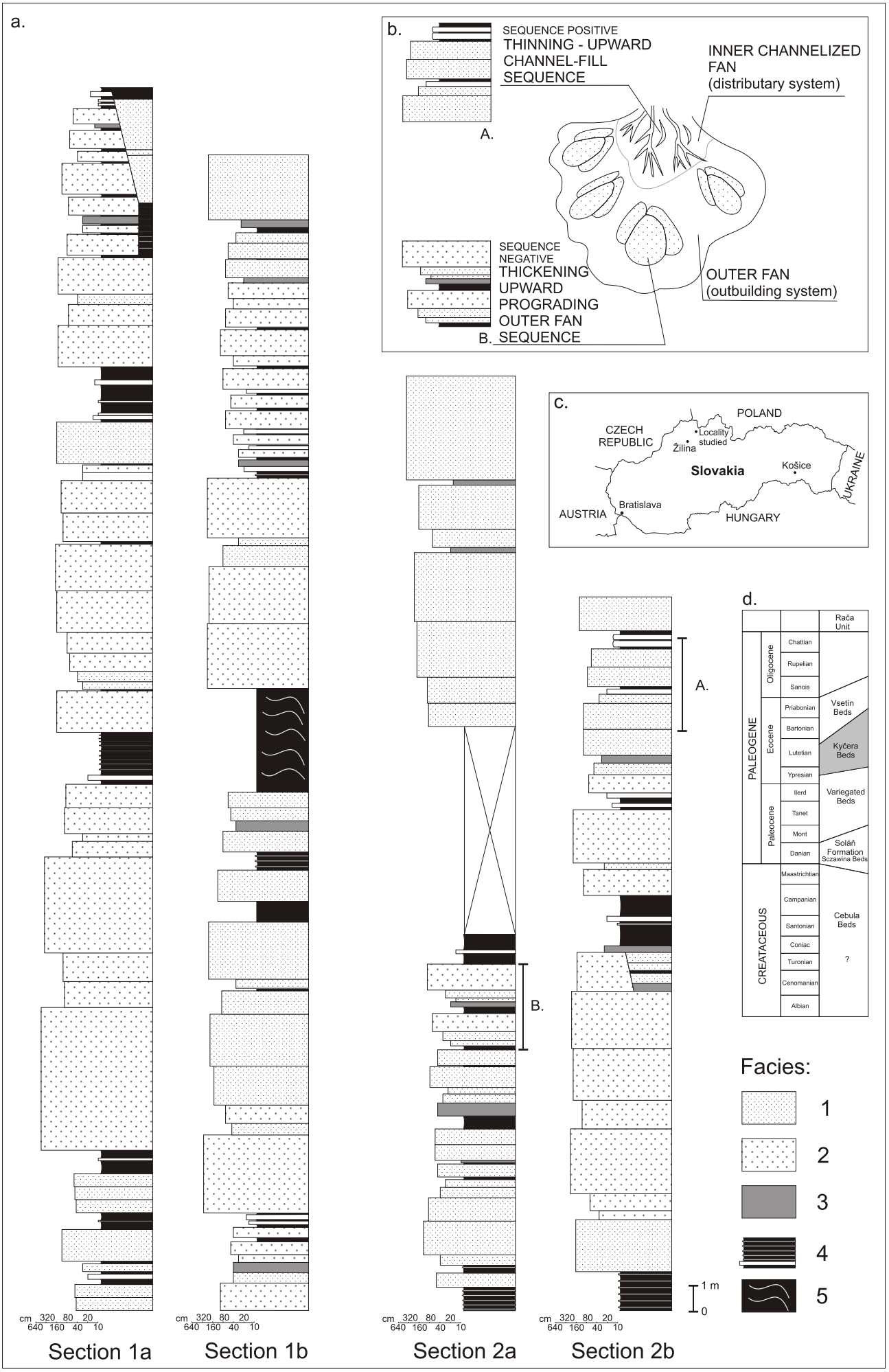
Mutti E., Ricci Lucci F., 1975: Turbidite facies and facies associations, In: C. H. Nelson, T. H. Nilsen: Modern and Ancient deep-sea fan sedimentation, SEPM short Course no. 14, Society of Economic Paleontologists and Mineralogists, 1984.

Pickering K., Stow D., Watson M., Hiscott R., 1986: Deep-Water facies, Processes and Models: A Review and Classification Scheme for modern and Ancient Sediments, Earth Science Reviews, 23, 75 – 174.

Starek, D. & Pivko, D., 2001: Sedimentological sections in the Rača subunit (Flysch belt, Western Carpathians, north of Bytča town). Miner. Slovaca, 33, 2, 91-102.

Fig. 1.

a. Sedimentological sections of the Kýčera Beds in the Klubina quarry (1a, b – 1st ettage, 2a, b - 2nd ettage). Facies 1 - 5 are described in the text.
b. Simplified model of deep-sea fan deposition, emphasizing channelized vs. nonchannelized sedimentation, compared to stacking patterns of sequential units in the Kýčera Beds (A., B.), (modified after Mutti & Ricci Lucci 1975).
c. Schematic situation of locality studied.
d. Stratigraphic column of the Rača Unit, denoted the position of the Kýčera Beds.


a.
b.
SEQUENCE POSITIVE
THINNING - UPWARD
CHANNEL-FILL
SEQUENCE
A.
INNER CHANNELIZED
FAN
(distributary system)
SEQUENCE
NEGATIVE
THICKENING
UPWARD
PROGRADING
OUTER FAN
B. SEQUENCE
OUTER FAN
(outbuilding system)
c.
POLAND
CZECH
REPUBLIC
Locality
studied
Žilina
Slovakia
Košice
UKRAINE
AUSTRIA
Bratislava
HUNGARY
d.
Rača
Unit
PALEOGENE
Oligocene
Eocene
Paleocene
Chattian
Rupelian
Sanois
Priabonian
Bartonian
Lutetian
Ypresian
Ilerd
Tanet
Mont
Danian
Vsetín
Beds
Kyčera
Beds
Variegated
Beds
Soláň
Formation
Sczawina Beds
CREATACEOUS
Maastrichtian
Campanian
Santonian
Coniac
Turonian
Cenomanian
Albian
Cebula
Beds
?
A.
B.
1 m
0
Facies:
1
2
3
4
5
cm 320 80 20
640 160 40 10
Section 1a
Section 1b
Section 2a
Section 2b