Middle Devonian tidal flat deposits at St. Pankrazen (Kollerkogel Formation, Gaisbergsattel Member) - preliminary data

HUBMANN, B.[1] & BRANDNER, H.[1]

(1) University of Graz, Institute of Earth Sciences (Geology and Palaeontology), Heinrichstrasse 26, A-8010 Graz, Austria; *bernhard.hubmann@uni-graz.at*; *herbert.brandner@student.tugraz.at*

Along the road South of St. Pankrazen a section exposes almost the entire succession of the Lower Devonian Flösserkogel Fm and the Middle Devonian Plabutsch and the Kollerkogel Fms. At the top of the calcareous Plabutsch Fm, the intercalation with a peculiar reddish-brown marly layer, is followed by an approximately 90 m thick succession of variegated dolostones. These dolostones are assigned to the Kollerkogel Formation.

In the course of a "lithostratigraphic revision" of all units of the Graz Palaeozoic FLÜGEL (2000) introduced the Kollerkogel Formation substitutional for the two former lithostratigraphic units "Kanzelkalk" (e.g. VACEK 1907, FLÜGEL 1975, EBNER et al. 1980) and the "Mitteldevon-Dolomit" (EBNER et al. 1980). In this concept both units have the rank of member only. The Kollerkogel Formation, named after Kollerkogel (Kollerberg 633 m) (N 47°03´46´´/ E 15°22´35´´) a hill belonging to the Plabutsch-Buchkogel-Range west of Graz, includes four members (FLÜGEL 2000):

Gaisbergsattel Member:	dark grey biolaminated dolostones; about 20 m (up to 100 m) in thickness
Kanzel Member:	light grey to bluish limestones; mostly mudstones; up to 100 m in thickness
Platzl Member:	sequence of grey limestones intercalated with carbonatic argillaceous shales; about 50 m in thickness
Platzlkogel Member:	grey limestones (in some places biohermal structures); about 75 m in thickness

Some investigations on the depositional environment of the Kanzel Member were summarized in the 1970ties and 80ties in PhD theses by HOSSEIN-NIKBACHT (1973) and HAFNER (1983), but until now little was known about the dolomitic parts (= Gaisbergsattel Member) of the Kollerkogel Formation (HUBMANN & MESSNER 2005).

According to the information provided in the literature these dolomites are generally considered as late diagenetic, untextured and massive rocks that achieve only few meters in thickness. In contrast to that in the St. Pankrazen area they reach thicknesses of up to 100 m and reach a prominent areal extent (HUBMANN et al. 2008), suggesting that they should be mapped as an independent formation.

Preliminary data of our recent study on that lithostratigraphic unit show that the succession comprises varied rocks, i.e. biolaminated dolomites, mudstones to bioclastic dolostones and clayey siltstones. Our investigations argue for a penecontemporaneous or early diagenetic origin rather than a late diagenetic formation.

Four microfacial types dominate: mudstones (25%), microbial bindstones (30%), crinoidal wackestones (28%), and brachiopod-tabulate packstones (17%). Their characteristics with respect to sulphur, TOC and gamma radiation are illustrated in Figure 1.

Fig. 1: Dataset of 69 beds from the St. Pankrazen section. Box-plots with median values (small squares), lower and upper quartiles (terminations of the boxes) and whiskers (minimum and maximum values) of microfacies types mentioned in the text. Data on sulphur and total organic content (TOC) in weight per cent; gamma ray activity in counts per second. Mudstones: Sulphur: number of measurements (nm) 15, mean value in weight per cent (mv): 0.069, standard deviation (sd): 0.157; TOC: nm: 11, mv: 0.086, sd: 0.027; gamma ray: nm: 17, mv: 22.47, sd: 13.22; Bindstones: Sulphur: nm: 21; mv: 0.037; sd: 0.022; TOC: nm: 14; mv: 0.079; sd: 0.027; gamma ray: nm: 42; mv: 17; sd: 8.34; Wackestones: Sulphur: nm: 19; mv: 0.027; sd: 0.014; TOC: nm: 16; mv: 0.399; sd: 0.333; gamma ray: nm: 19; mv: 16; sd: 8.91;

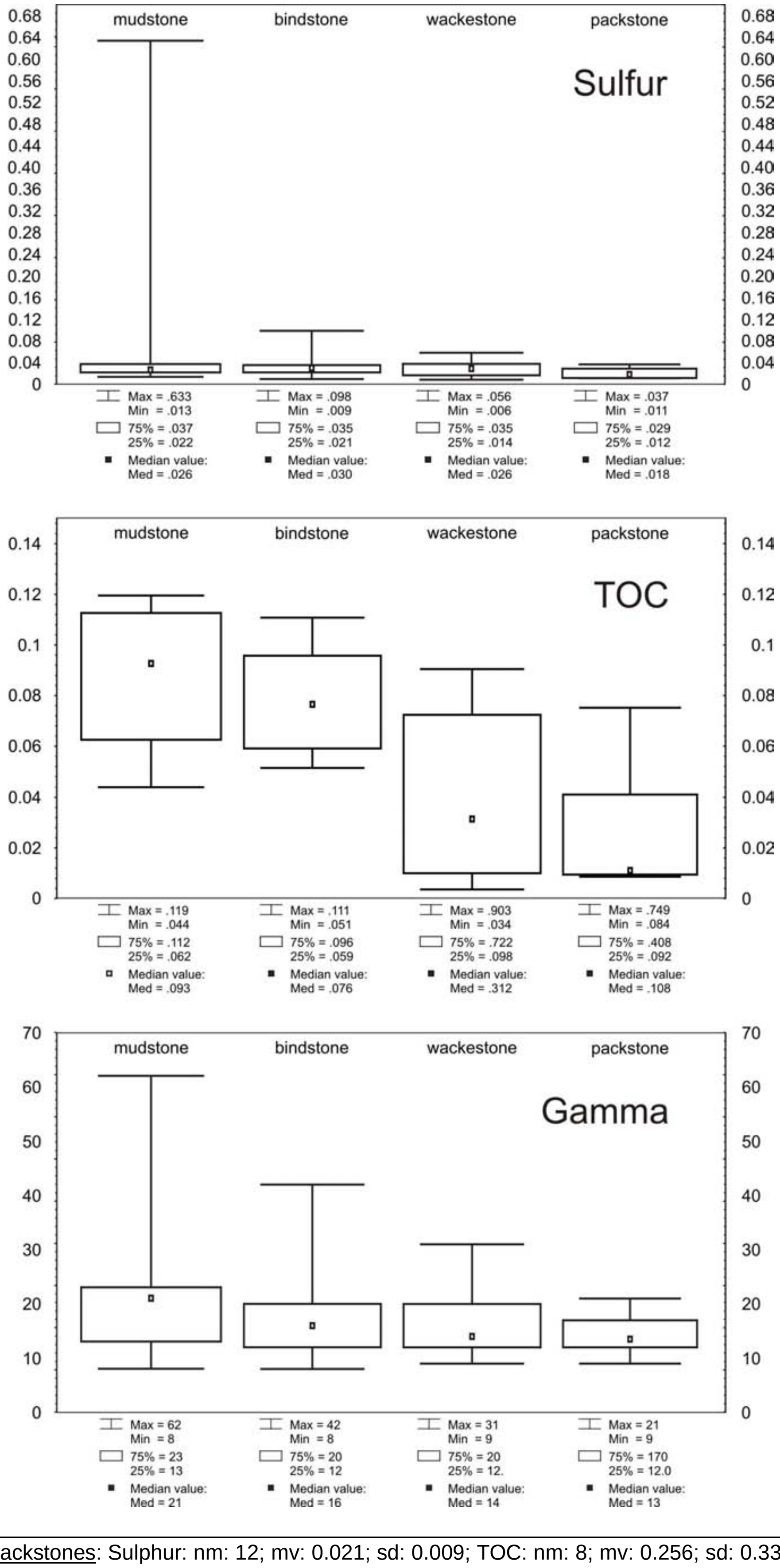


Fig. 1 continued: Packstones: Sulphur: nm: 12; mv: 0.021; sd: 0.009; TOC: nm: 8; mv: 0.256; sd: 0.333; gamma ray: nm: 12; mv: 14.42; sd: 3.55; Note the decrease of data distribution from higher values and wide ranges to the left of the diagrams (i.e. mud- and bindstones) to generally lower ranges that are more concentrated around their mean values (and median values respectively) to the right (wacke- and packstones).

Laminated rocks, either stromatolitic layers (microbial mats) commonly composed of micrite laminae with laminoid fenestrae and very fine grained intraclasts from desiccation, or varve-like rhythmic alternations of coarse and fine laminae are interpreted as intertidal mudflat deposits (Pl. 1: A-B). Some brachiopod shells floating in wackestone "matrix" are totally dissolved and displaced by cascades of dogtooth cement suggestive of emersion horizons (Pl. 1: F). Mudstones may have developed in cut-off lagoons and/or coastal ponds with restricted water circulation, whereas the crinoidal wackestones and brachiopod-tabulate packstones developed under shallow subtidal conditions. Shallow water environments that did not suffer from exsiccation were settled by auloporid tabulates (Pl. 1: H).

The dolomitic succession described (= Gaisbergsattel Member) is sandwiched between sequences that are characterized by abundantly fossiliferous limestones (mostly coral-stromatoporoid float- to rudstones) of peri-reef-environments: the underlying Plabutsch Fm and the overlaying Platzlkogel Mb of the Kollerkogel Fm. Due to the lack of age diagnostic fossils the boundaries of the Gaisbergsattel Member are unknown. Since the Plabutsch Fm is Eifelian (no detailed conodont zone known) and the upper part of the Kollerkogel Fm is Givetian (*varcus* Zone; *asymmetricus* to *triangularis* Zone) the age of the Gaisbergsattel Member is supposed to be Upper Eifelian or Lower Givetian. A transition of a subtidal to an intertidal setting that changes rapidly again to a subtidal situation during Lower Givetian would correspond harmonically with sea-level fluctuations observed by JOHNSON et al (1985) at that time interval (Fig. 2).

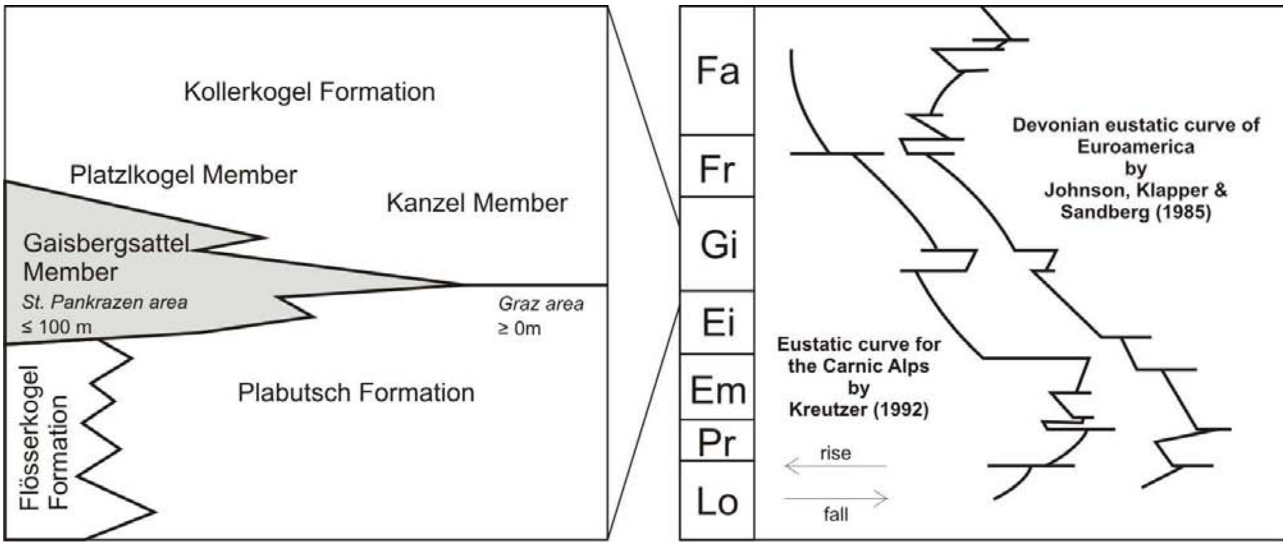


Fig. 2: Lithostratigraphic scheme on the left illustrating the position of the Gaisbergsattel Member. According to field observations we assume that the Flösserkogel Fm passes into the Gaisbergsattel Mb in some places of the St. Pankrazen area. Both units have similar facies developments (i.e. pertidal deposits). Note the strong variation in thickness of the Gaisbergsattel Member.

Right part illustrates the qualitative eustatic curve for the Devonian of Euramerica (simplified after JOHNSON et al. 1985) and KREUTZER (1992) for the Carnic Alps. The abrupt sea-level fall in the Givetian may correspond with a facies change of the subtidal Plabutsch Fm to the intertidal mud flats of the Gaisbersattel Mb.

References:

EBNER, F., FENNINGER, A. & HOLZER, H.-L. (1980): Die Rannach-Fazies des Grazer Paläozoikums. - Mitteilungen der Abteilung für Geologie, Paläontologie und Bergbau am Landesmuseum Joanneum, 41: 49-65.

FLÜGEL, H. (1975): Die Geologie des Grazer Berglandes. - Erläuterungen zur Geologischen Wanderkarte des Grazer Berglandes 1:100.000, Geologischen Bundesanstalt, Wien. - 2. Edition, Mitteilungen der Abteilung für Geologie, Joanneum, Sh. 1: 1-288.

FLÜGEL, H.W. (2000): Die lithostratigraphische Gliederung des Paläozoikums von Graz (Österreich). - *In*: FLÜGEL, H.W. & HUBMANN, B. (Eds.): Das Paläozoikum von Graz: Stratigraphie und Bibliographie. - Österreichische Akademie der Wissenschaften, Schriftenreihe der Erdwissenschaftlichen Kommissionen, 13: 7-59.

HAFNER, H. (1983): Die Geologie der Hohen Rannach bei Graz (Grazer Paläozoikum, Steiermark). - Unpublished PhD Thesis, Karl-Franzens University Graz: 1-156.

HUBMANN, B. & MESSNER, F. (2005): Grazer Paläozoikum. - Exkursionsführer 75. Jahrestagung der Paläontologischen Gesellschaft, Institut für Erdwissenschaften Graz: 1-47.

HUBMANN, B., WINKLER, G. & MASSER, E. (2008): Der (hydro)geologische Rahmen von „Sinterquellen“ im Raum St. Pankrazen/Weststeiermark. - Mitteilungen des naturwissenschaftlichen Vereines für Steiermark, 137: 21-32.

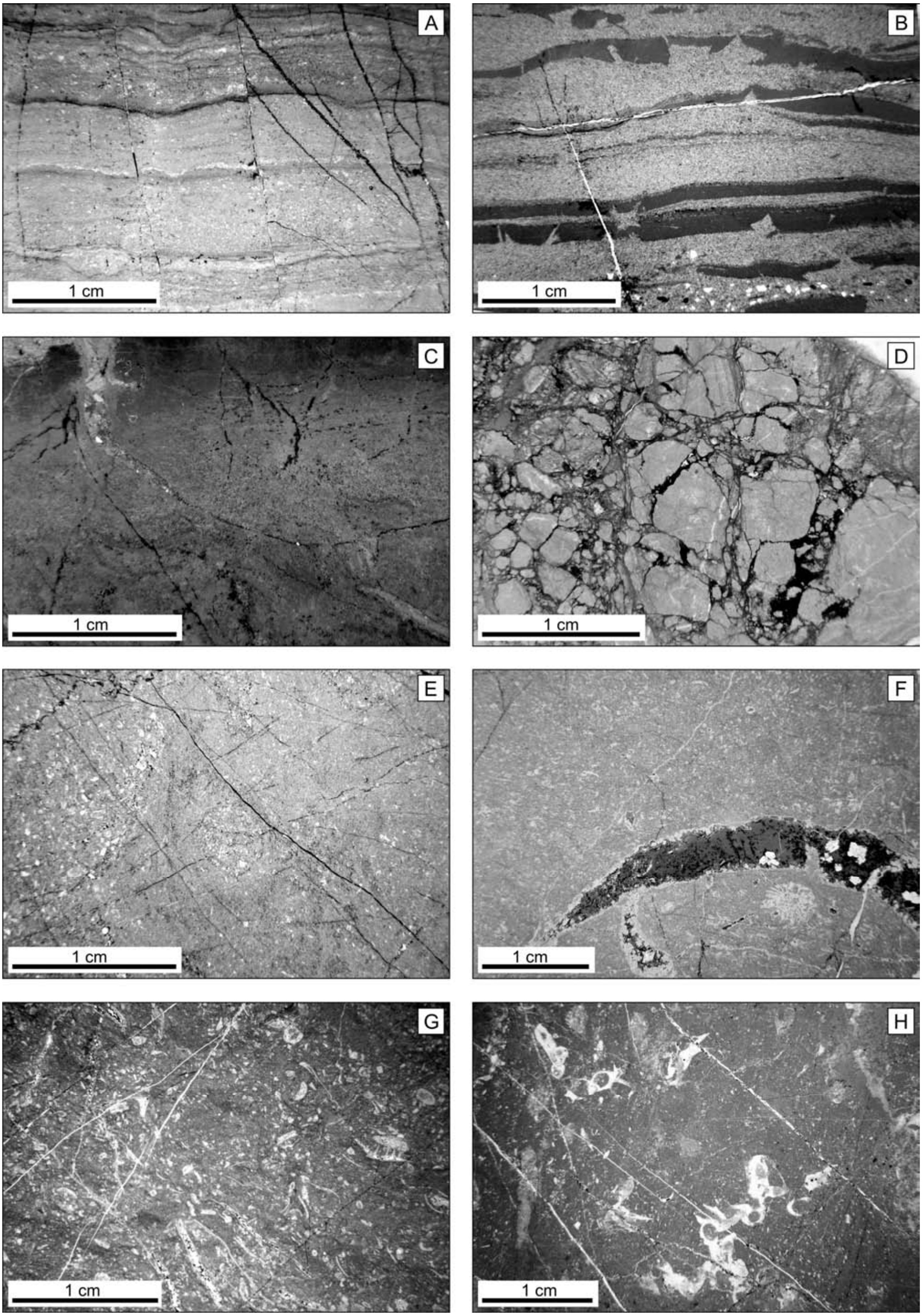
HOSSEIN-NIKBACHT, M. (1973): Die geologischen Verhältnisse des Hahngraben-Gebietes, südlich der Rannach (Graz). - Unpublished PhD Thesis, Karl-Franzens University Graz: 1-129.

JOHNSON, J.G., KLAPPER, G. & SANDBERG, C.A. (1985): Devonian eustatic fluctuations in Euramerica. - Bulletin of the Geological Society of America, 96: 567-587.

KREUTZER, L. (1992): Photoatlas zu den varizischen Karbonat-Gesteinen der Karnischen Alpen (Österreich/Italien). - Abhandlungen der Geologischen Bundesanstalt, 47: 1-129.

VACEK, M. (1907): Weitere Bemerkungen zur Geologie des Grazer Beckens. - Verhandlungen der kaiserlich-königlichen Geologischen Reichsanstalt: 159-192.

Plate 1: A. Slightly irregular biolamination passing into crinkly lamination in the upper part; B. Peloidal grainstone with silt-sized quartz components alternating with micritic ‘chips’ or flakes’. The ‘chips’ and flakes’ structures are presumably deriving from desiccation of tidal-flat muds (cf. Pl.1: C) or from partially lithified subtidal lime muds which were disrupted by storms; C. Fossil-free mudstones without sedimentary structures; D. Postsedimentary brecciation of dolomitic mudstone; E. Bioturbated wackestone; F. Wackestone with thamnoporid tabulate corals and dissolved brachiopod shell. Note replacement of skeletal carbonate by dogtooth cement; G. Wackestone with predominantly unidentifiable bioclasts. Fragment of a rugose coral to the right; H. Clusters of auloporid tabulate corals in mud/wackestones indicate a pioneer stage of settlement. - A-H: photomicrographs of thin-sections. – (see page 20)


A
1 cm
B
1 cm
C
1 cm
D
1 cm
E
1 cm
F
1 cm
G
1 cm
H
1 cm