

PLATES

Plate 1: Lithofacies types of the Jebel Rheris area.

1. Five SH – type stromatolites with columnar growth forms (between arrows) developed from a basal LLH – type stromatolite (FT 11, upper Famennian, section 16).
2. Two cross-sections of echinoid spines (arrows) within a bioclastic wacke-/packstone. The matrix partly recrystallised, whereby micro- and pseudospar grew (FT 10, lower Frasnian, section 1).
3. Coarse grainstone, mostly consisting of crinoid ossicles and brachiopod shells (FT 9, middle Frasnian, section 1).
4. Iron oolite with iron-stained, opaque matrix and partly ferruginized calcitic ooids. Some crinoidal debris in lower part of the photograph (FT 12, lower Famennian, section 10).
5. Conglomerate, consisting of phosphatic black pebbles (bp), dark and subangular limestone clasts (li) and bright dolostone components (do) (FT 13, Famennian, section 6).
6. Brachiopod coquina, which serves as a marker horizon in Givetian strata (FT 6, middle Givetian, section 4). Top of the layer to the right.
7. Bioclastic packstone, components with sutured contacts and 5 % quartz grains (white) (FT 7, Famennian, section 3).
8. Bioclastic grainstone, mostly composed of crinoid ossicles and a bryozoan fragment (FT 7, Frasnian, section 1).

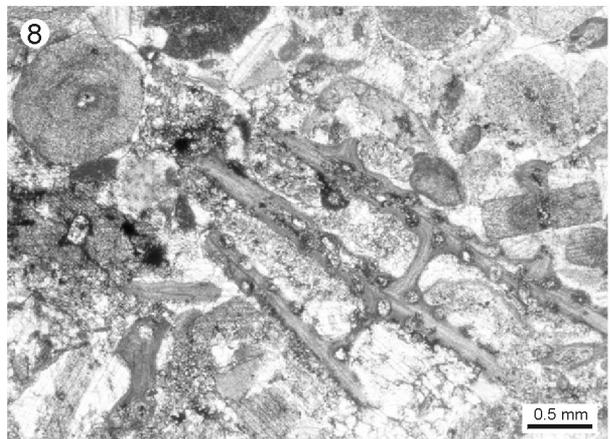
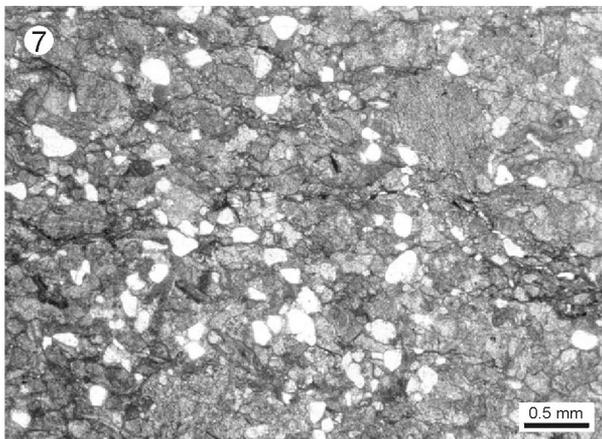
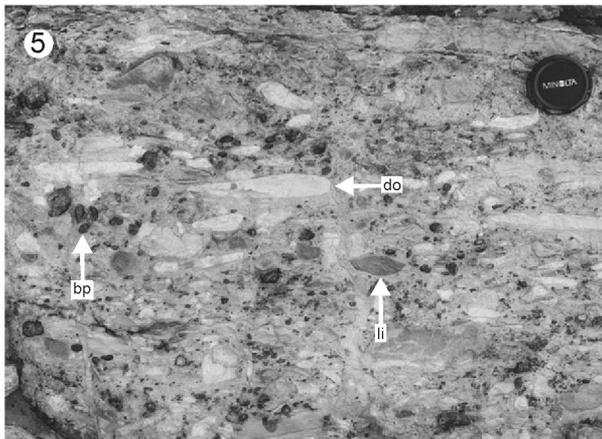
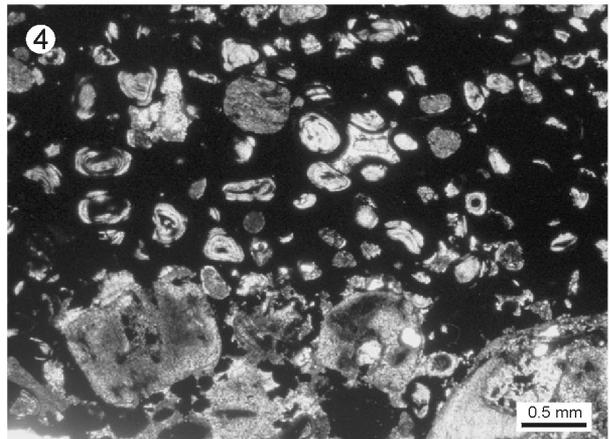
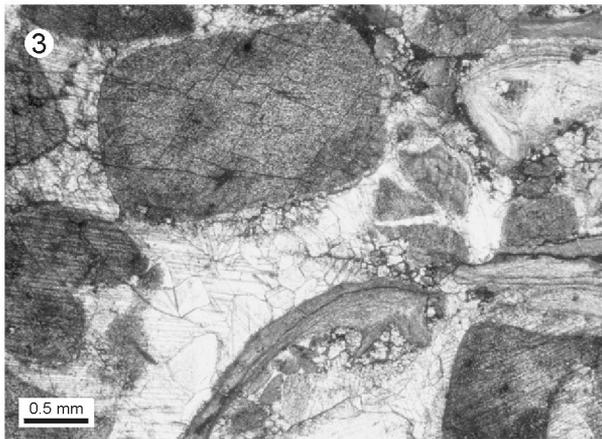
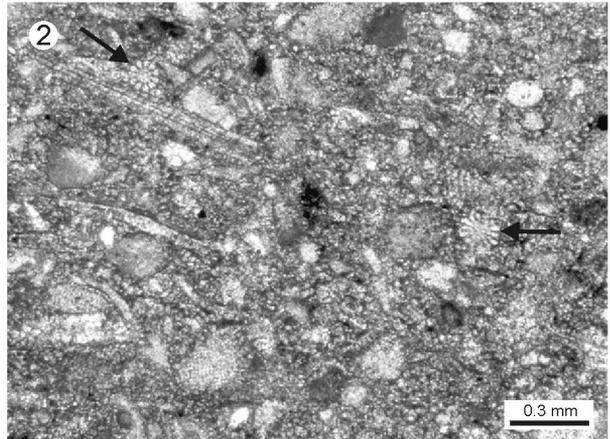


Plate 1

Plate 2: Lithofacies types of the Jebel Rheris area.

1. Ripple casts at the bottom of a FT 7 layer (Famennian, section 11).
2. Poorly washed peloidal grainstone with a large crinoid ossicle (lower right) and dacryoconarids, the latter often are arranged cone-in-cone (arrow) (Lower part of thin section 52, FT 3, Givetian, southwestern Jebel Rheris).
3. Poorly washed peloidal grainstone, containing some shell fragments and dacryoconarids (Upper part of thin section 52, FT 3, Givetian, southwestern Jebel Rheris).
4. Styliolinid wacke-/packstone, containing a large gastropod (FT 2a, Emsian, section 1).
5. Bioclastic wackestone, containing ostracods (lower left, with geopetal filling), gastropods (lower centre), mollusc fragments, which often are bored (FT 2b, Emsian, section 1).
6. Debrite (within dashed lines), intercalated in Famennian shales (partly covered with recent talus), which consists of limestone and some dolostone clasts and a 40 cm long fragment of a laminated limestone layer (FT 8, eastern Jebel Rheris).
7. Debrite of reworked limestones in Famennian shales (FT 8, eastern Jebel Rheris).
8. Upper Emsian shales, into which dacryoconarid wackestone layers (dashed lines) are intercalated towards the top (left) with increasing abundance (FT 1, section 1).

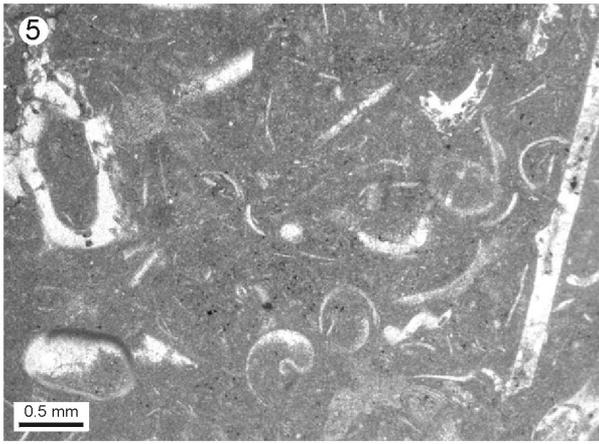
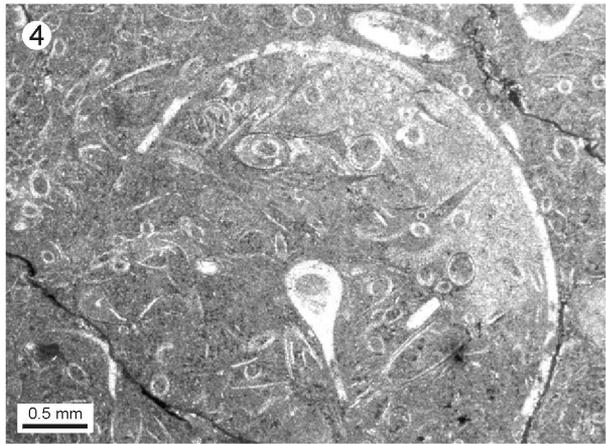
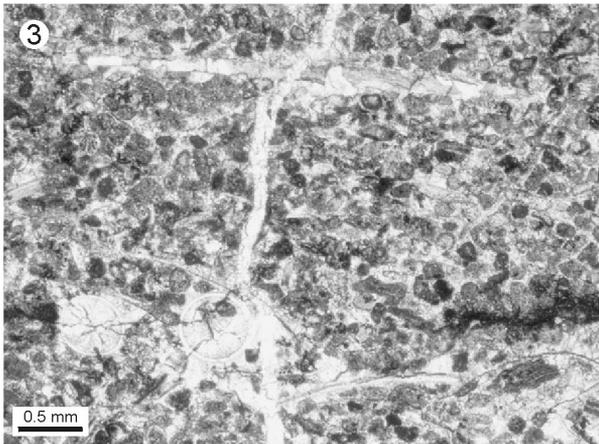
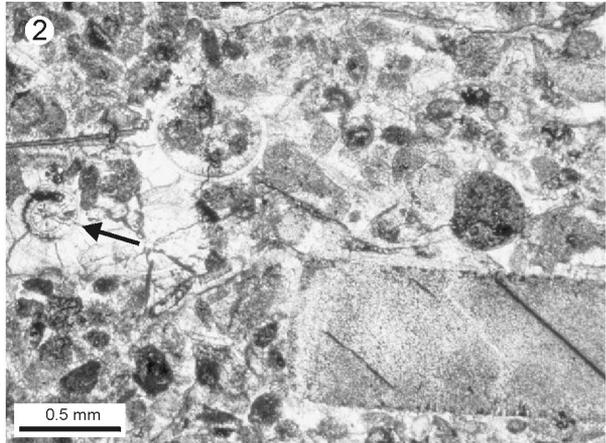


Plate 2

Plate 3: Outcrop pictures.

1. Eastern part of the eastern Jebel Rheris syncline, showing Givetian to upper Famennian deposits. Note the location of middle Famennian shales, which occur about 40 m east of section 1. (View towards the NW.)
2. Angular unconformity between Lower Emsian nodular limestones and upper Famennian conglomerate (section 7, 1.3 km NW of the Jebel Rheris).
3. Angular unconformity between two Famennian conglomerate layers (section 11, western Jebel Rheris).
4. Angular unconformity between Eifelian limestones and an Upper Devonian conglomerate at the top (3.5 km WSW of the Jebel Rheris, 600 m east of section 10).
5. Neptunian dike, filled with upper Famennian crinoidal limestone, cutting the bedding plane of a Givetian coquina (top of section 14, northern Jebel Rheris).
6. Neptunian dike, cutting the bedding plane of a Givetian limestone layer at the top of section 14. The void first was filled with light-grey Famennian crinoidal limestone, a second filling generation consists of dark (?Tournaisian) sandstone (top of section 14, northern Jebel Rheris).
7. Northern flank of the eastern Jebel Rheris syncline. Core of syncline (right) is uppermost Famennian (Upper *expansa* – Middle *praesulcata* Zone). (View towards the E; the mountain ridge is approximately 2 km long.)

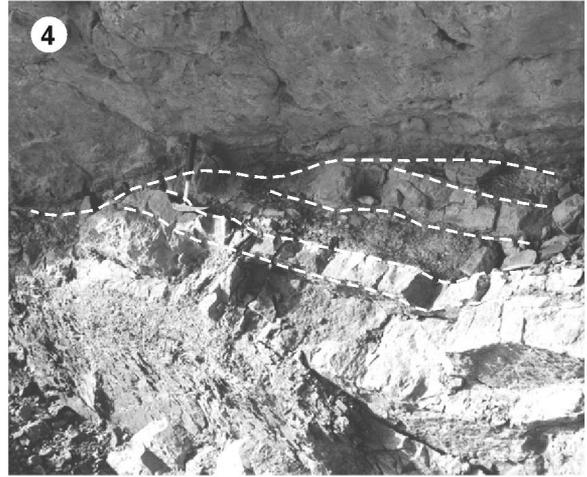
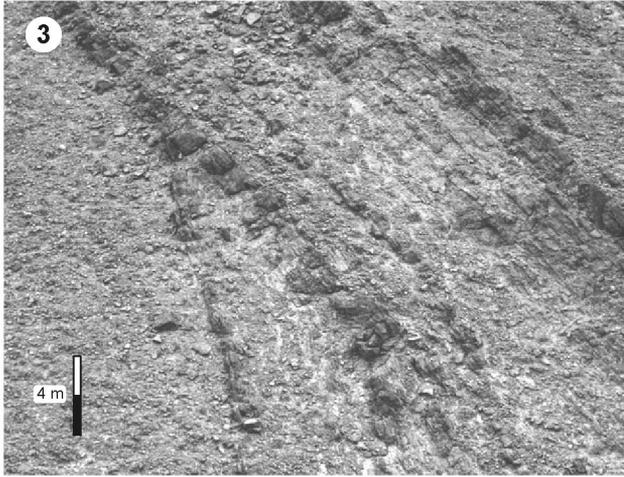
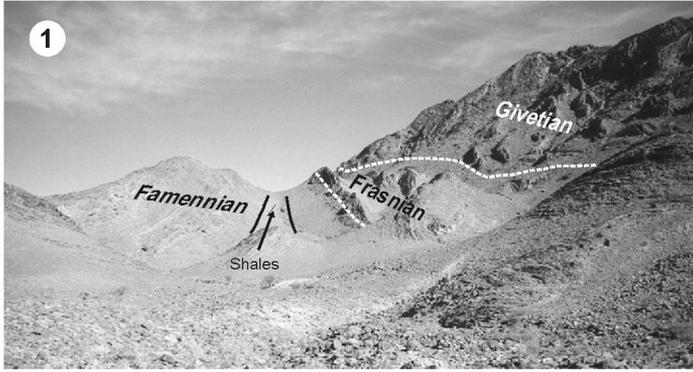


Plate 3

Plate 4: Givetian microfacies and outcrop features.

1. Grainstone with syntaxially cemented crinoid ossicles, abundant peloids, and intraclasts. Crinoidal-grainstone facies, upper part of section 1.
2. Parabiostrome B 1 in the upper half of the picture contains transported stromatoporoids and corals, unconformably overlying crinoidal grainstones. Section 1.
3. Composite biostrome B 3, consisting of an autoparabiostromal facies in the lower and an allobiostromal facies in the upper part. Section 1.
4. *Zoophycos* on the bedding plane of a crinoidal limestone layer, lower part of section 1.
5. Stromatoporoids with a domical growth form in vertical section of parabiostrome B 5. The matrix between the larger components is selectively dolomitised. Section 1.
6. Bedding plane in upper part of section 1 with mostly *in situ* corals and stromatoporoids (within dashed lines). Phase b (lateral dispersion) of the colonisation stage is preserved.
7. Favosites overgrowing a stromatoporoid in biostrome B 7, section 1.
8. Stromatoporoids with domical to bulbous growth forms in a selectively dolomitized matrix near section 9 (vertical section).

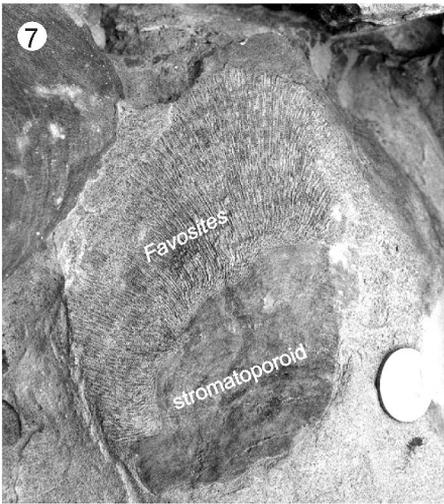
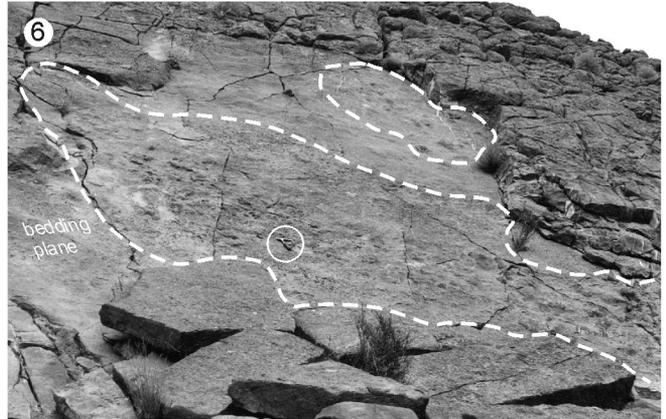
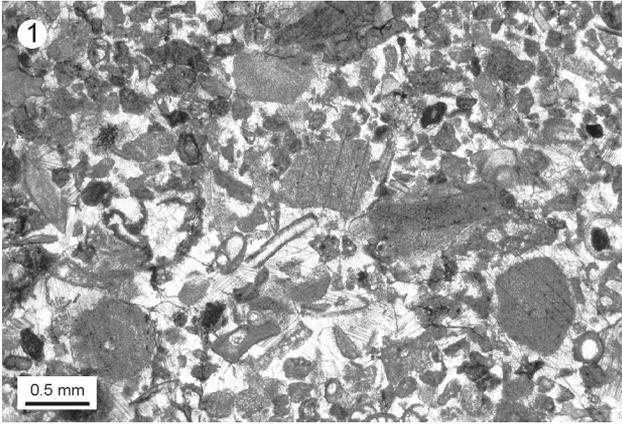


Plate 4

Plate 5: Diagenetic features of Givetian carbonate rocks.

1. Cathodoluminescence (CL) view of an intraskeletal pore of a thamnoporoid coral, filled by an isopachous rim of fibrous calcite (FC), showing a bright yellow luminescence at the bottom of the crystals, then a patchy moderate yellow to non-luminescent zone and again a thin bright luminescent zone at the top. Blocky spar I (BS 1) precipitated in the centre of the pore with a zoned bright luminescence in the outer parts, which becomes non-luminescent in the inner part of the pore. Section 4, sample 33-I.
2. Pore filling of a bryozoan fragment under CL: The first cement generation is made up of mostly non-luminescent scalenohedral calcite (SC), the second generation of bright yellow blocky spar I (BS 1). Section 9, sample 49-I.
3. CL view of an echinoderm fragment, surrounded by stylolites, which cut into a non-luminescent brachiopod shell at the bottom. In the dull orange luminescent echinoderm fragment grew microdolomites (dots). Section 9, sample 48-I.
4. The same echinoderm fragment as in No. 3 in the centre of this picture under plane polarized light. Microdolomites appear as black dots. Insoluble residue was concentrated along stylolites, creating black seams. Section 9, sample 48-I.
5. CL view of an idiotopic dolomite mosaic. Rhombs show straight crystal faces and a distinct alternation of dull orange/red and thin bright zones. A fracture cut the matrix and the dolomite crystals, the latter often were cracked along growth lines (arrow). Western part of the Jebel Rheris, sample 8-II.
6. Same area as in No. 5, plane polarized light. Zones of the dolomite rhombs with an extremely high iron content appear opaque. Western part of the Jebel Rheris, sample 8-II.
7. Isolated euhedral dolomite rhombs under CL. About 13 more or less dull orange/red growth zones can be distinguished, the outermost zone mostly is bright luminescent. Western part of the Jebel Rheris, sample 8-II.
8. CL view of fractures that developed during different generations. They were filled with ferroan blocky spar II (BS 2), which shows a dull unzoned luminescence. Southwestern edge of the Jebel Rheris, sample 52-II.

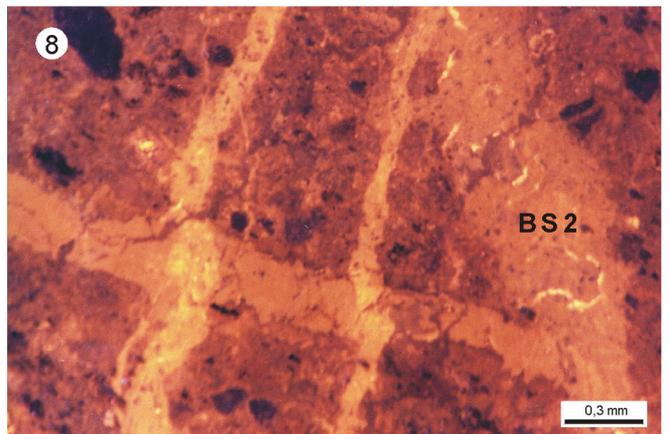
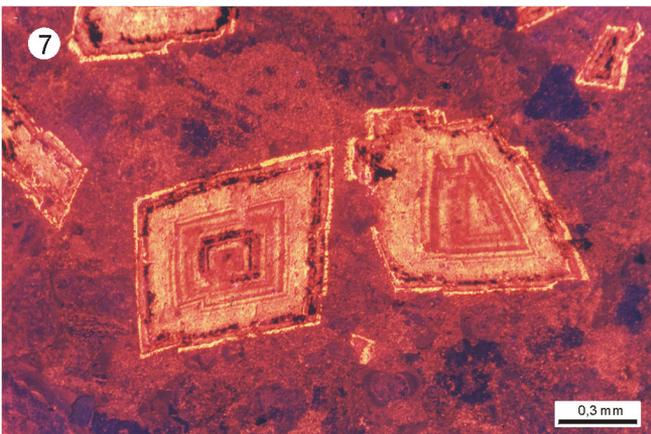
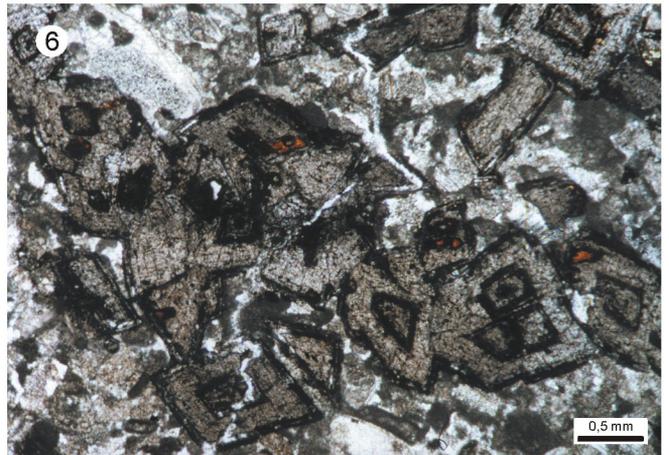
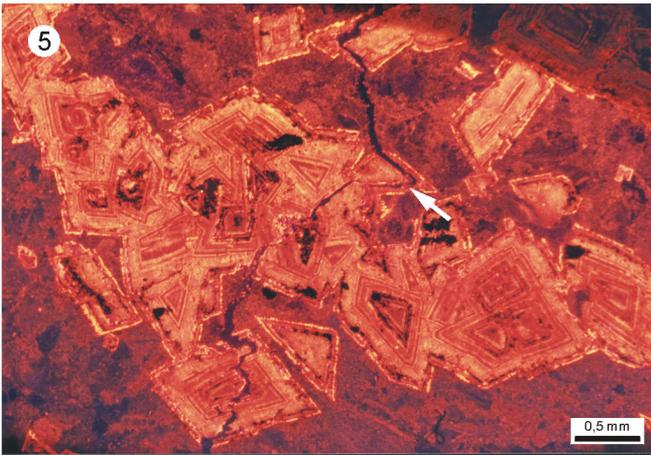
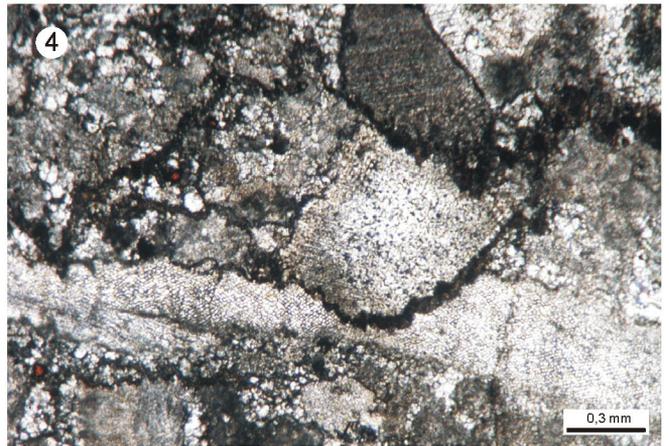
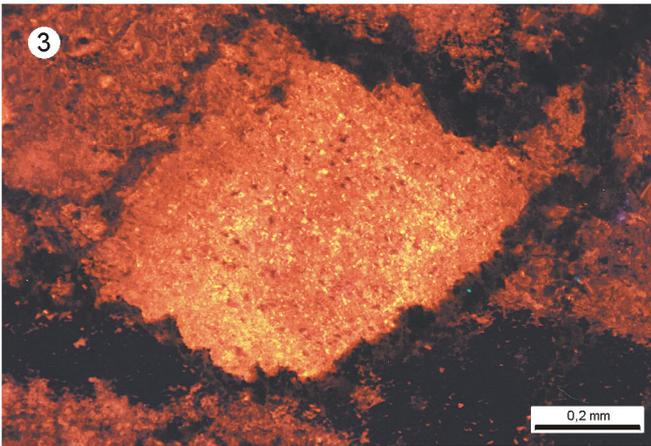
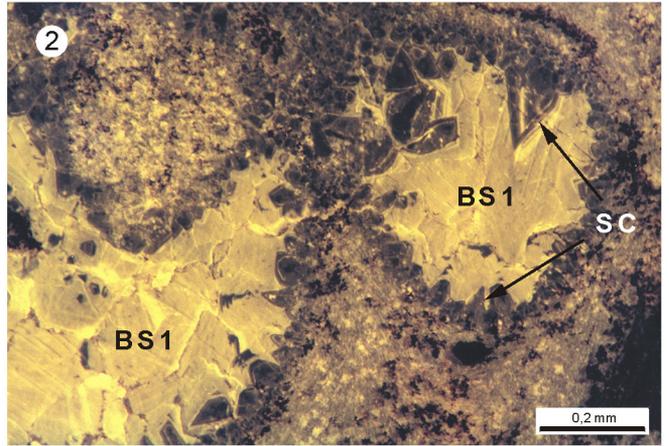
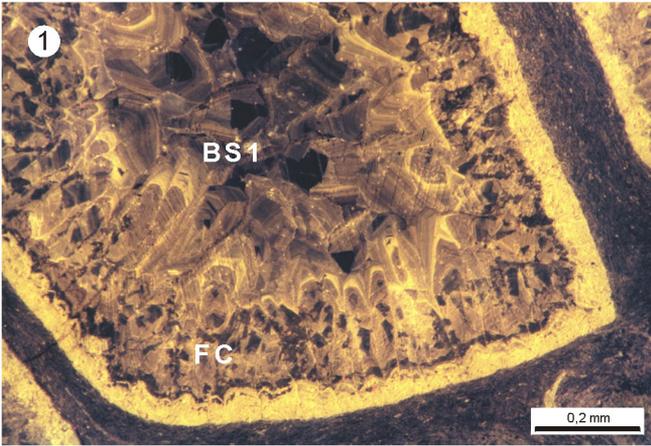


Plate 5

Plate 6: Diagenetic features of Givetian carbonate rocks.

1. Part of Pl. 5, No. 1 seen under crossed polars. Fibrous calcite cement (FC) shows unit extinction and straight twin plains; crystals grew between 0,1 and 0,17 mm in length, and 0,02 to 0,05 mm in width. Blocky spar I (BS1) precipitated as the second cement generation. Section 4, sample 33-I.
2. The same picture as Pl. 5, No. 2, crossed polars. Only blocky spar I (BS1) can be recognised as a cement in the pores of a bryozoan fragment, scalenohedral cement is not visible. Section 9, sample 49-I.
3. Plane polarized light view of Pl. 5, No. 8. Fractures of different generations in a poorly washed grainstone, dominated by peloids, were filled by blocky spar II (BS 2). Southwestern edge of the Jebel Rheris, sample 52-II.
4. Non-luminescent scalenohedral calcite (SC) around a styliolinid and was succeeded by bright-luminescent blocky spar I (BS1). Section 9, sample 49-I, CL view.
5. Biostrome in the lower part of section 1, consisting of transported fragments of stromatoporoids and tabulate corals (dark clasts). The matrix including smaller components was selectively dolomitised (bright area).
6. Ridge of Givetian biostromes and crinoidal grainstones, where dolomitised areas (D) cut through the original layers, thus obscuring the otherwise distinct bedding. Ca. 1 km south of section 14.
7. Cavities in dolomitised Givetian rock. These were probably calcitic relics, which were dissolved after the matrix was dolomitised. Ca. 1 km east of section 9.
8. Oval area of calcitic spar in dolomitised Givetian rock. This is presumably a former stromatoporoid, which was replaced by blocky spar. Section 1, between biostromes B1 and B2.

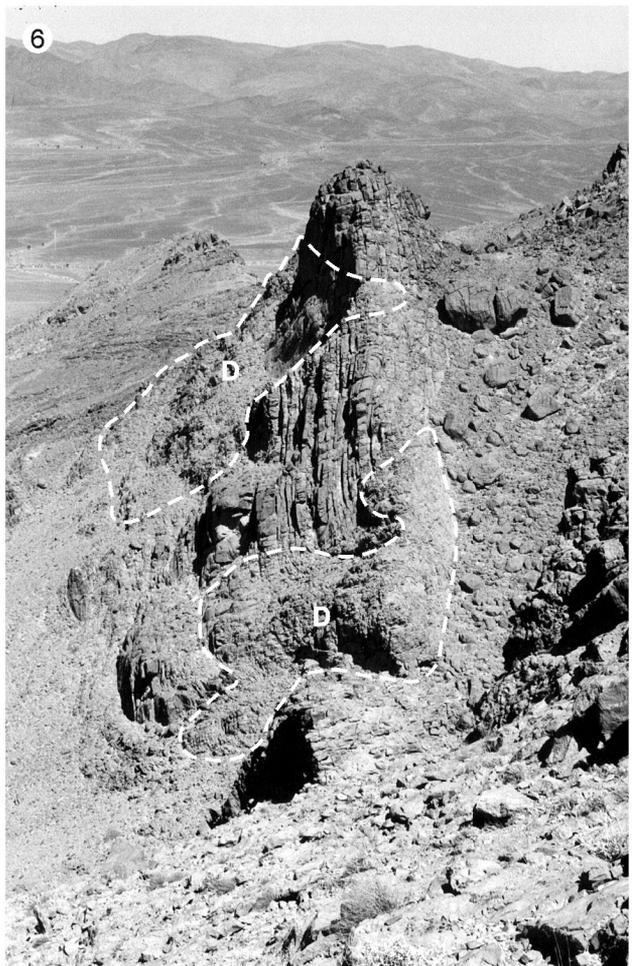
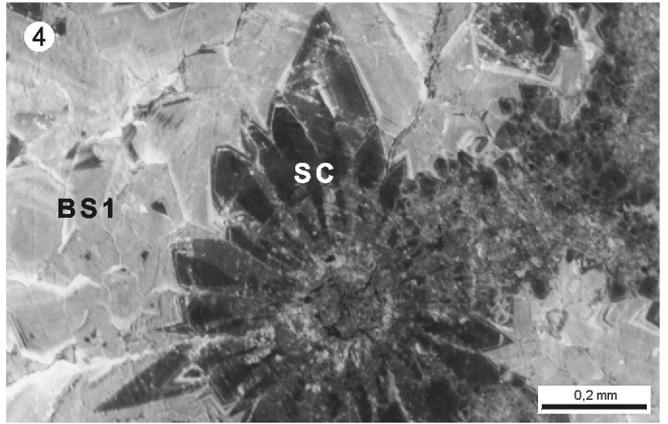
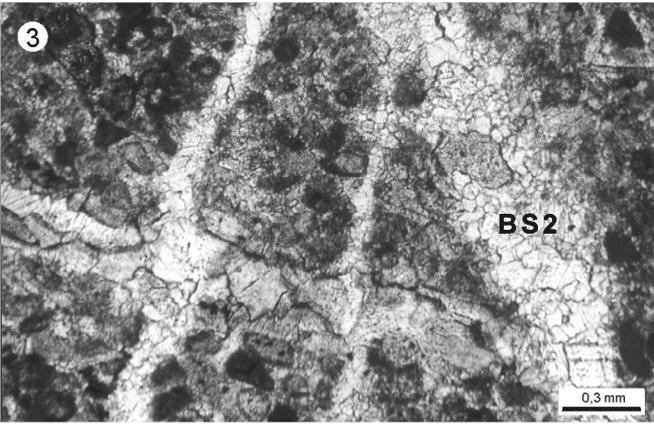
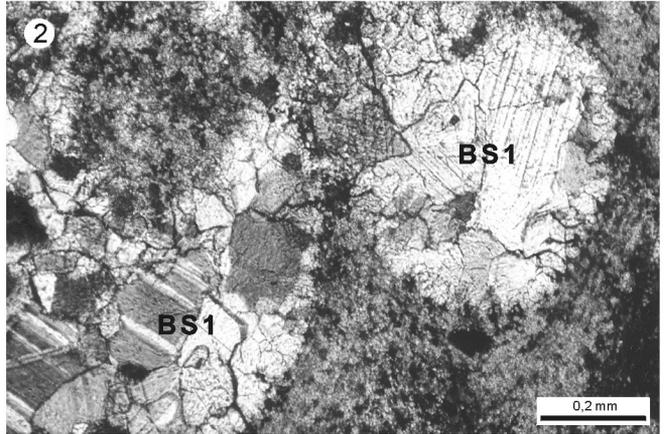
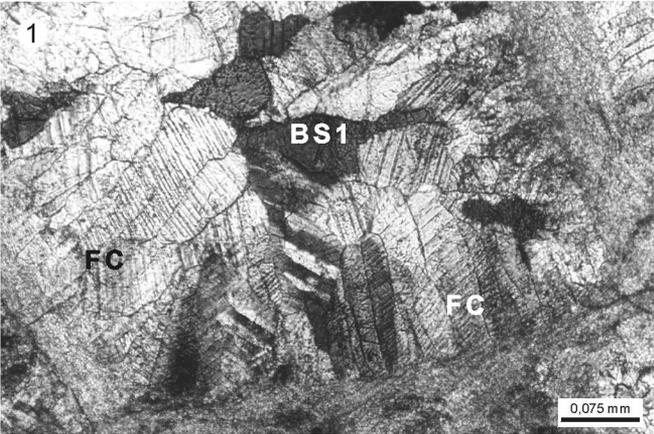


Plate 6

Plate 7: Macro- and microfacies of phosphatic type 1 black pebbles.

1. Black pebbles on a bedding plane (section 1, Middle *expansa* – Middle *praesulcata* Zone, eastern Jebel Rheris).
2. Relics of a 10 cm thick conglomerate, made up of black pebbles (bedding plane, upper part of section 4, eastern Jebel Rheris).
3. Black phosphatic pebbles, which consist of silt sized quartz grains and a vertebrate remain (upper left), floating in crinoid ossicles and some sand sized quartz grains (section 4, thin section 37I).
4. Black pebble at the top contains quartz grains (qz) and parallel-oriented muscovite (mu) (section 4, thin section 13a).
5. SEM photograph of the freshly fractured surface of a black pebble. The hexagonal crystal structure of microcrystalline apatite (arrows) developed only rarely in the matrix between quartz grains.
6. Black pebble, made up of quartz grains and ooids (section 2, thin section 10II).
7. Elongated black pebble occurs together with crinoid ossicles and vertebrate remains (arrows). (section 4, thin section 13g).
8. Black pebble with several microfractures, which do not pass over into the adjacent upper Famennian facies. (section 4, thin section 12II).

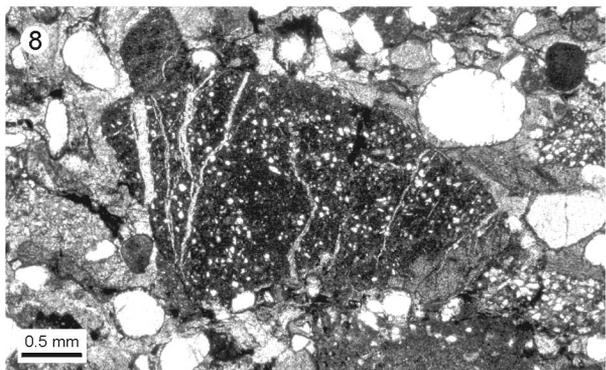
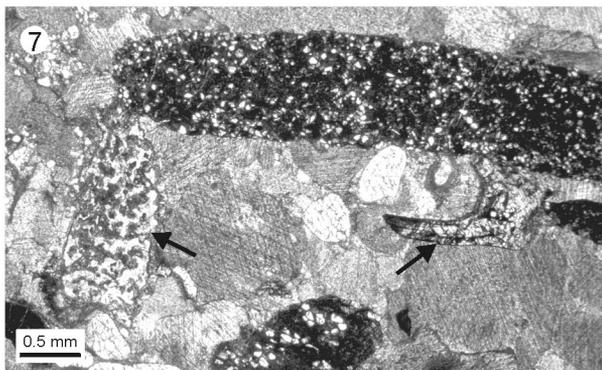
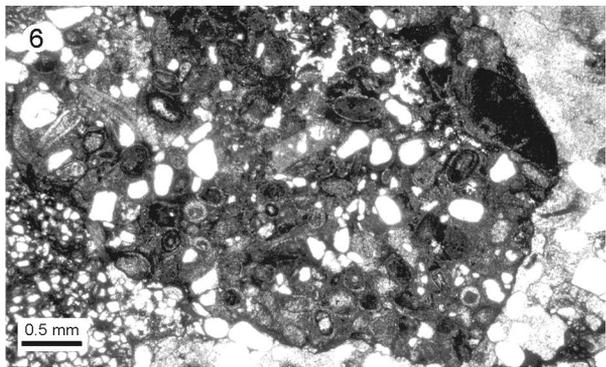
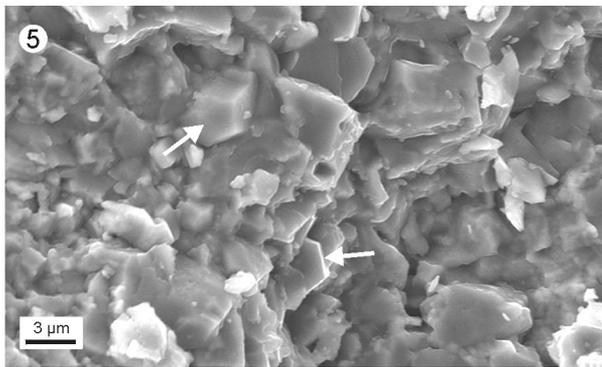
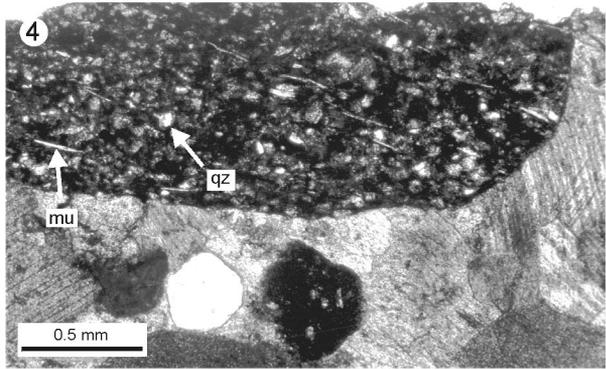
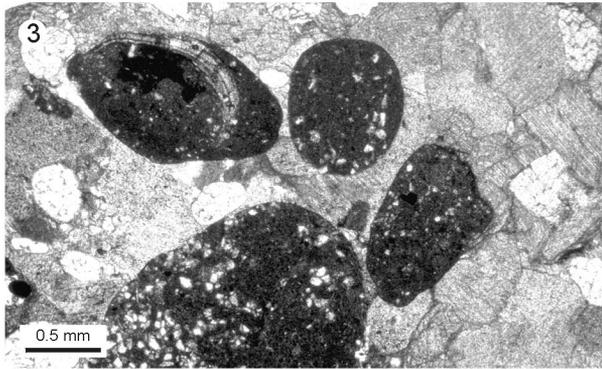


Plate 7

APPENDIX

Fischer Plots - Givetian, section 1

Cycle-No.	Thickness [m]
1	28
2	3.8
3	6.4
4	4.7
5	1.6
6	1.6
7	7.5
8	2.6
9	1.7
10	9
11	3.5
12	6.7
13	9.8
14	8.2
15	5.7
16	1.3
17	5.3
18	2.5
19	4
20	3.5
21	2
22	3.6
23	7
24	7.9
25	3.1
26	1
27	2.2
28	7
29	1
30	4.1
31	2.4
32	1.2
33	1.8
34	1.7
35	1.3
36	1
37	1.2
38	0.8
39	0.8
40	2.2
41	2
42	1.1
43	3.2
44	1.7
45	1.7
46	13.5
47	2
48	10
49	13.5
total:	219.4

Mean cycle thickness: 4.48 m

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Betreuer: Prof. Dr. Werner Buggisch

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