2016

Micropalaeontology, Palaeoenvironments and Sequence Stratigraphy of the Sulaiy Formation of Eastern Saudi Arabia

ALENEZI, SALEH

Plate 55

A. Meandering wall structure type of calcareous sponge, possibly cf. *Raphidonema* sp., Well-D, 7957.2', field of view 5 mm.

B. *Cladocoropsis mirabilis* Felix (1927), Well-I, 5482.2'.

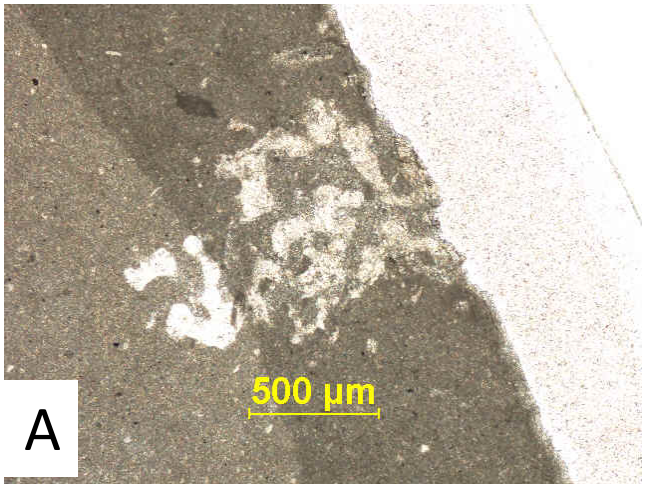
C. *Cladocoropsis mirabilis* Felix (1927), Well-I, 5482.2'.

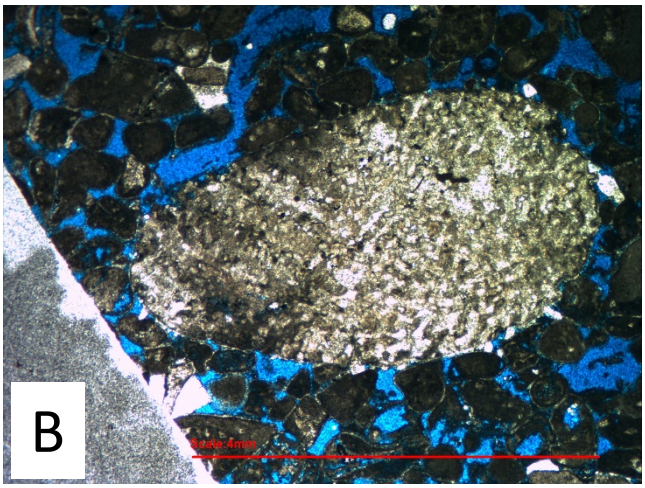
D. *Cladocoropsis mirabilis* Felix (1927), Well-I, 5482.2'.

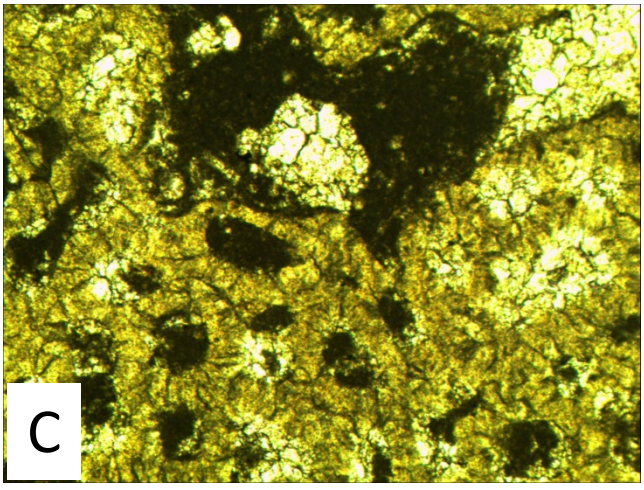
E. *Cladocoropsis mirabilis* Felix (1927), Well-I, 5531.7'.

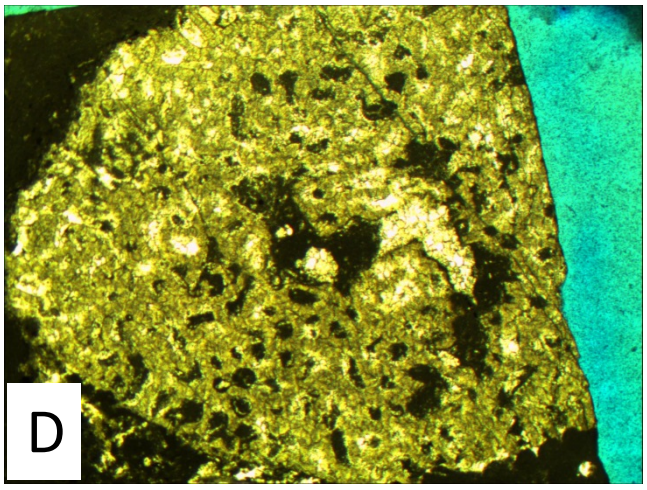
F. Stromatoporoid, Well-I, 5531.7'.

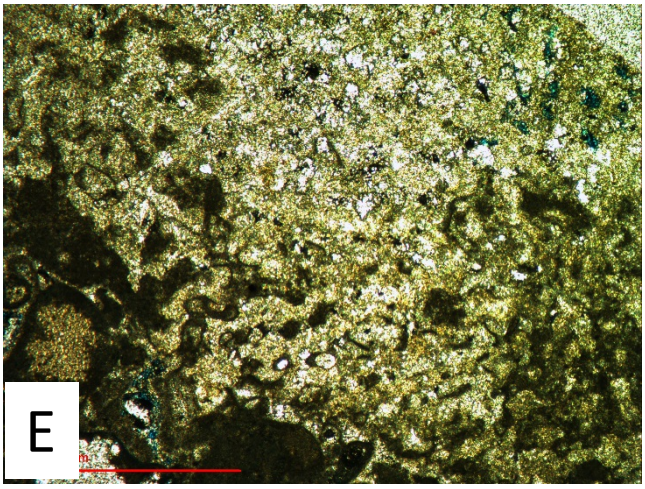
Plate 55











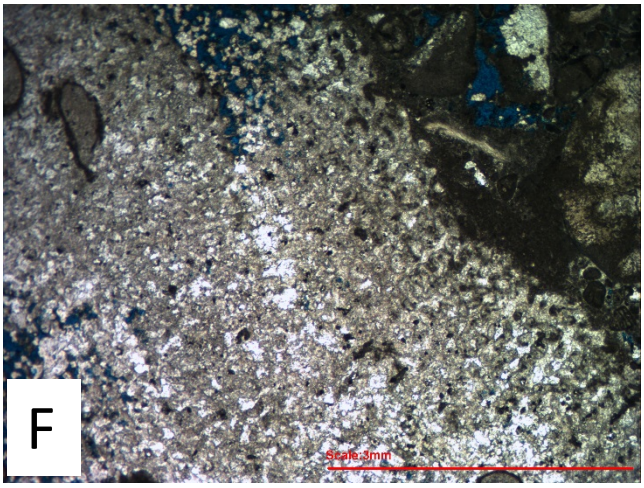


Plate 56

A. Possibly calcisponge clotted roots wackestone, Well-I, 5474.7', field of view 16 mm.

B. Dinocyst, Well-A, 4058.7', field of view 2.5 mm.

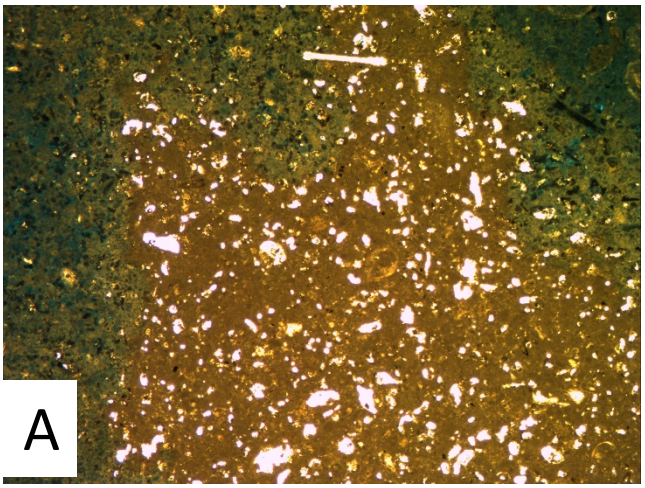
C. *Comittosphaera sublapidosa* (Volger, 1941), showing uneven inner and outer walls, Well-A, 4061.6', field of view 2.5 mm.

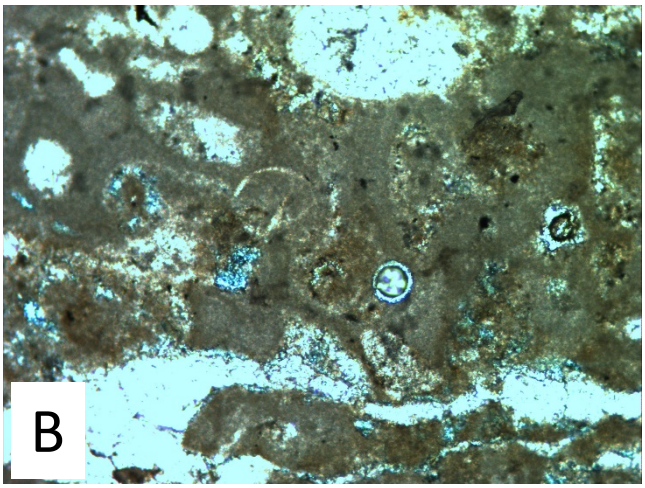
D. Dinocyst, Well-G, 6775.6', field of view 2.5 mm.

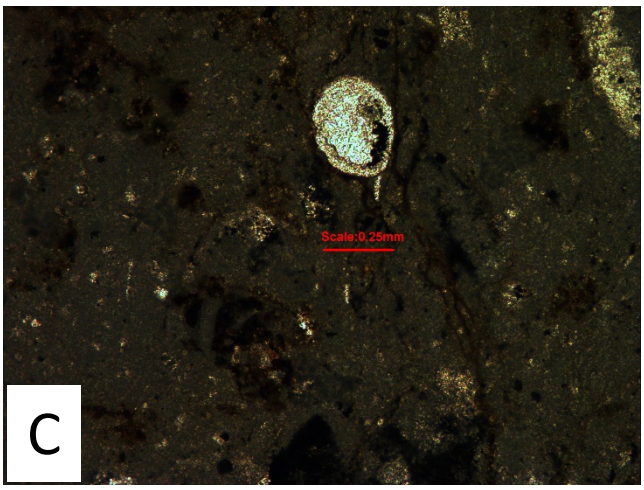
E. *Colomisphaera cieszynica* Nowak (1968), Well-G, plug # 100, field of view 2.5 mm.

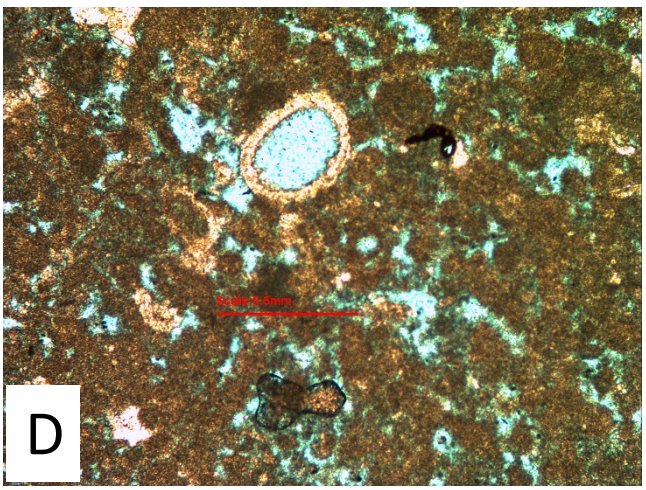
F. Dinocyst, Well-B, 8427', field of view 2.5 mm.

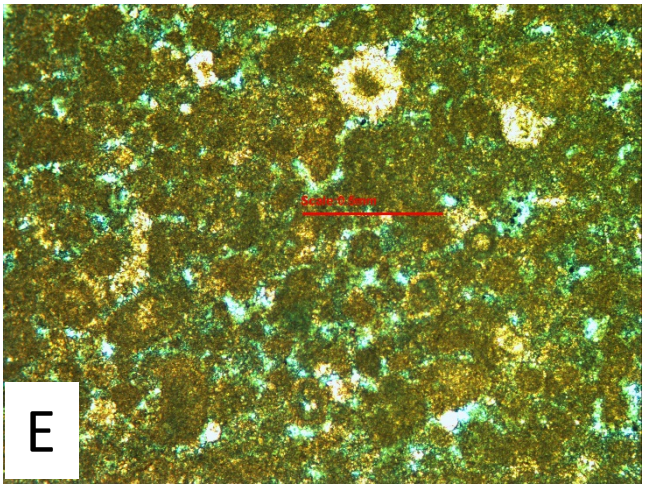
Plate 56











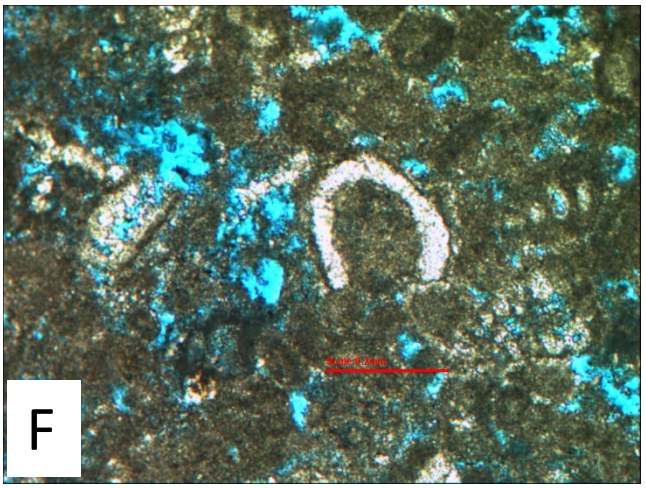
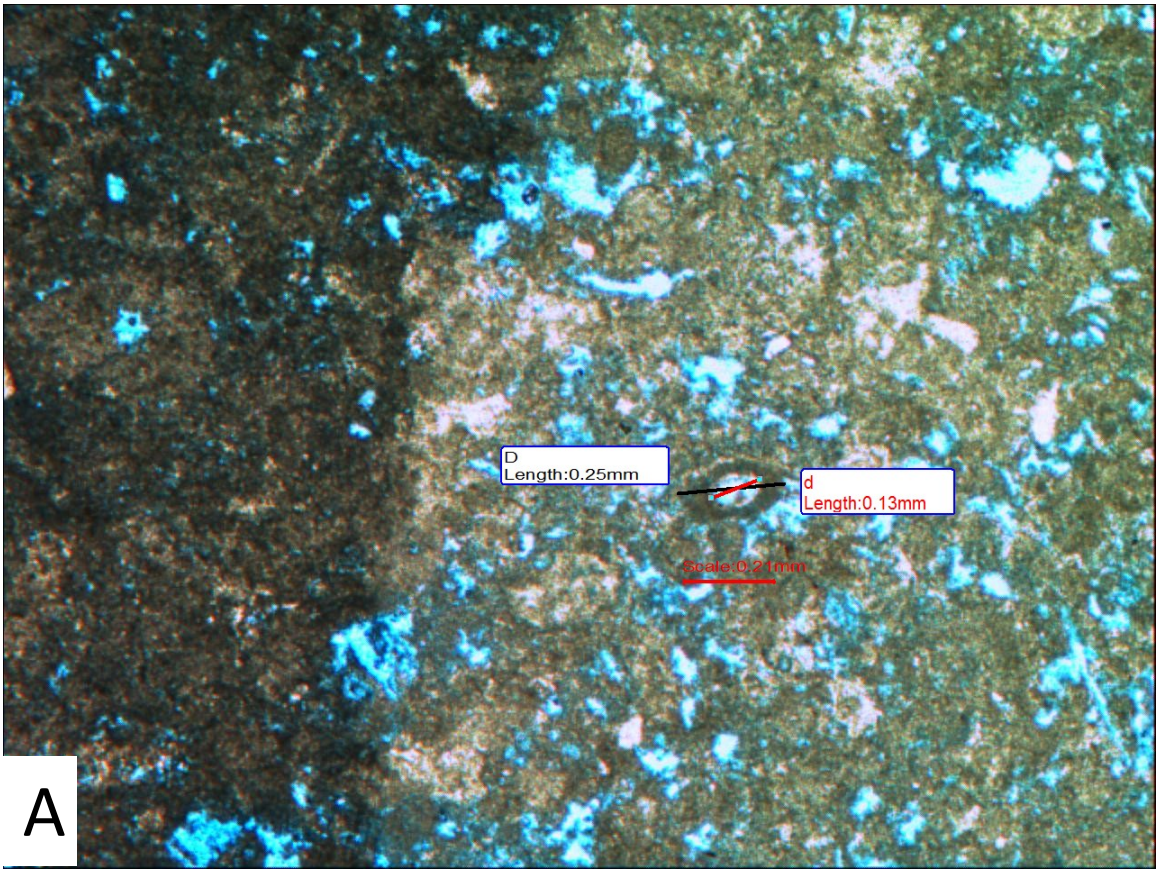


Plate 57

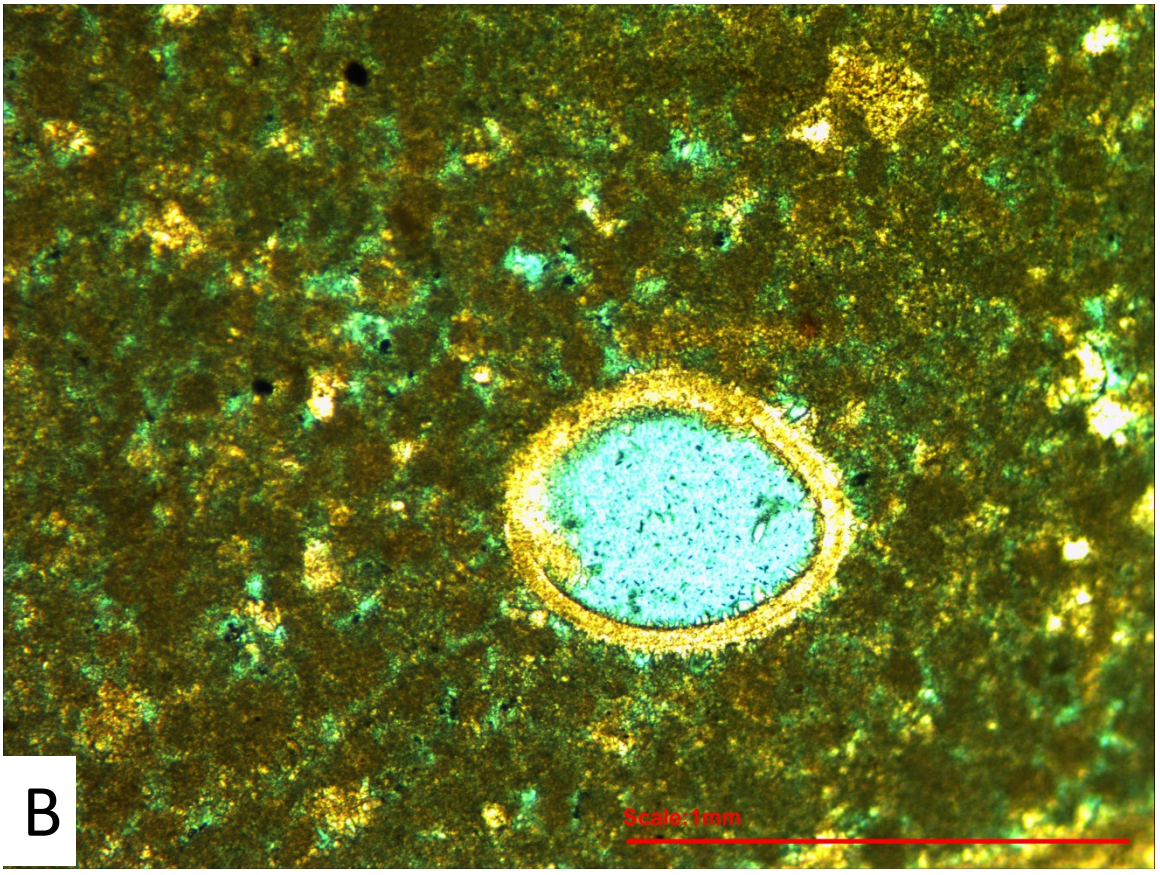
A. Possible Calcisphere, (D) Length 0.25 mm, d (internal length) 0.13 mm, Well-B, 8432.5’.

B. *Stomiosphaera wanneri* Borza (1969), stratigraphical range is from upper Berriasian to Hauterivian, Well-G, 6811.3’, field of view 2.5 mm.

Plate 57



A



B

Plate 58

A. *Stomiosphaera wanneri* Borza (1969), image taken with polarized light (XPL), not the cross extinction, Well-G, 6811.3', field of view 2.5 mm.

B. *Stomiosphaera wanneri* Borza (1969), stratigraphical range is from Berriasian to Valanginian, Well-G, 6811.3', field of view 2.5 mm.

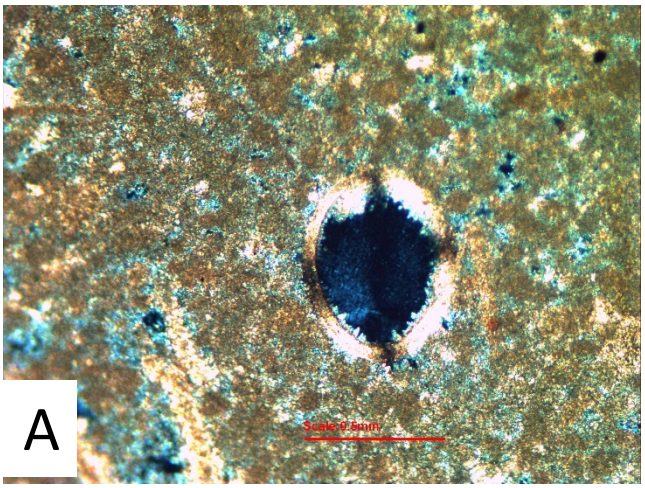
C. *Crustocadosina semiradiata* (Wanner, 1940), Well-G, 6809.5', field of view 2.5 mm.

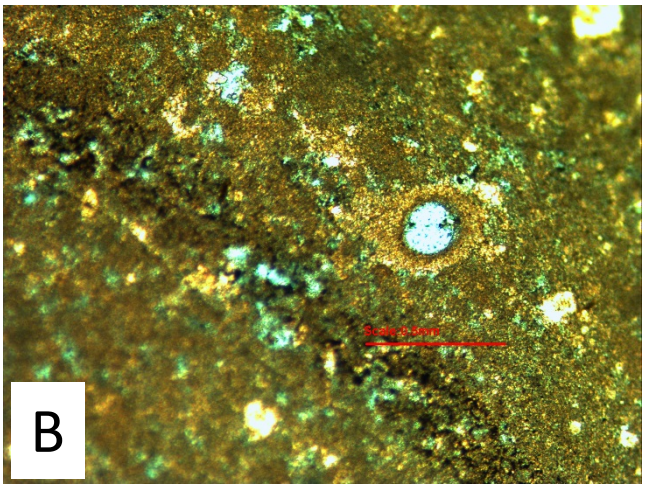
D. *Crustocadosina semiradiata* (Wanner, 1940), Well-G, 6811.3', field of view 2.5 mm.

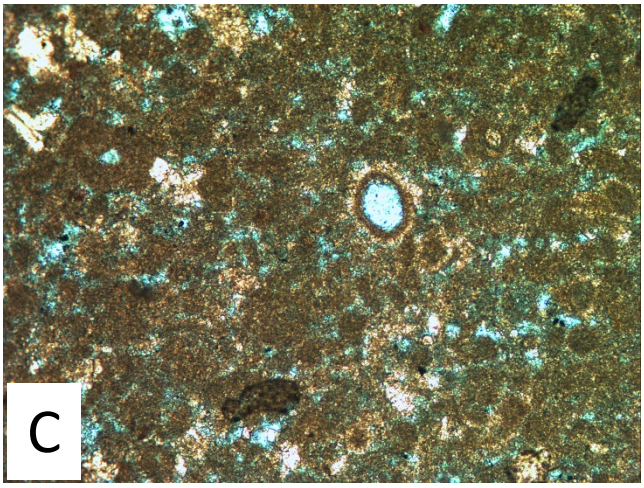
E. *Macroporella praturloni* Dragastan (1999), Well-G, 6809.5', field of view 2.5 mm.

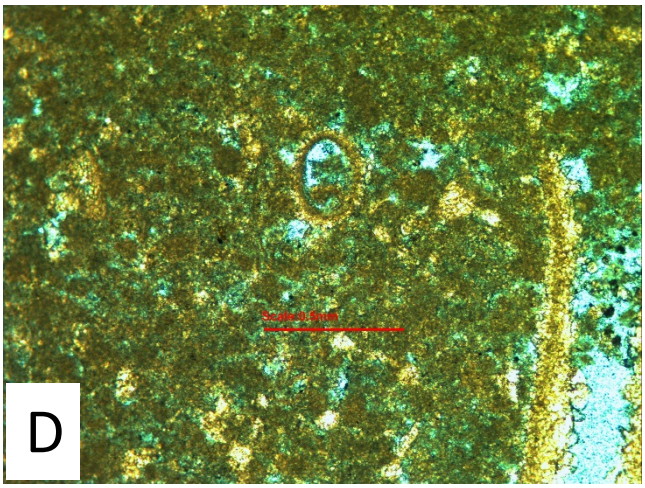
F. *Macroporella praturloni* Dragastan (1999), Well-G, 6809.5', field of view 2.5 mm.

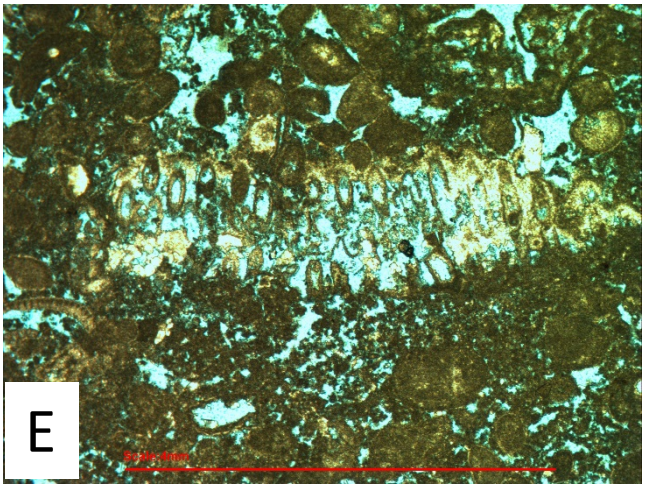
Plate 58











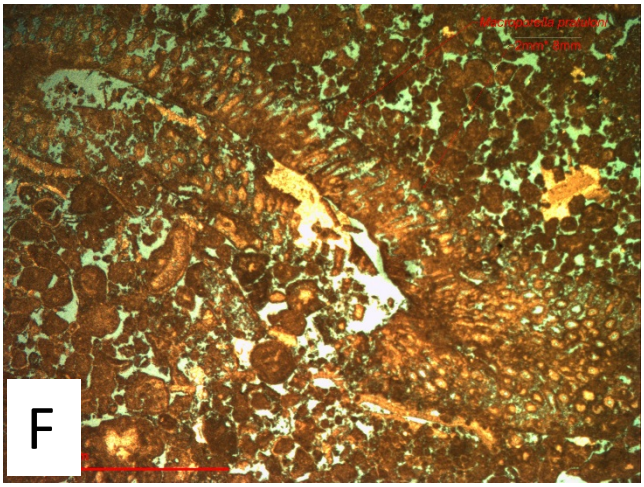


Plate 59

A. *Actinoporella podolica* (Alth, 1878), Well-B, 8365.1', field of view 6.3 mm.

B. *Actinoporella podolica* (Alth, 1878) and a gastropod mold in lagoonal skeletal wackestone, Yamama Formation, Well-B, 8365.1', field of view 6.3 mm.

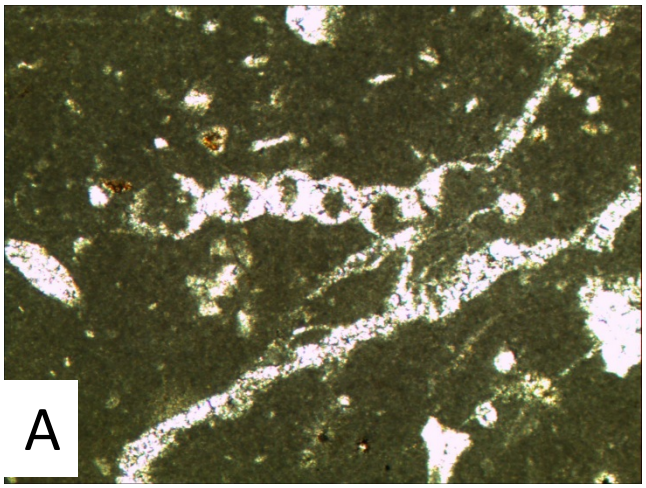
C. *Actinoporella podolica* (Alth, 1878), Well-B, 8365.1', field of view 6.3 mm.

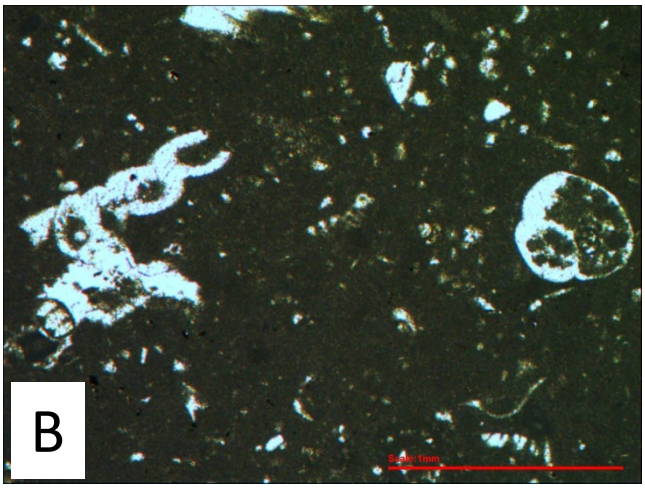
D. *Actinoporella podolica* (Alth, 1878), Well-B, 8365.1', field of view 6.3 mm.

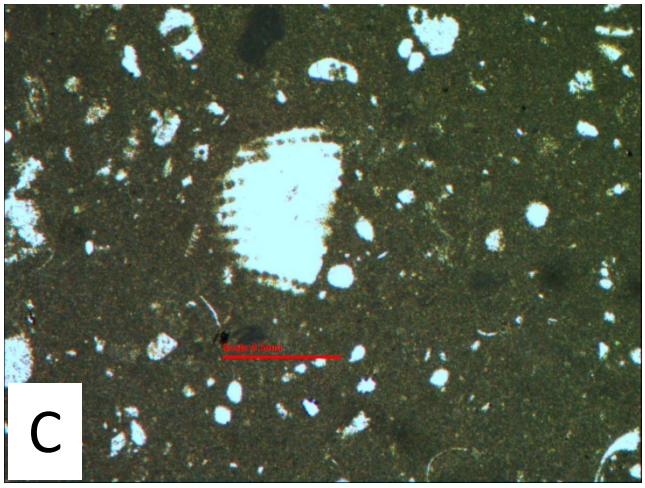
E. *Actinoporella podolica* (Alth, 1878), Well-B, 8365.1', field of view 2.5 mm.

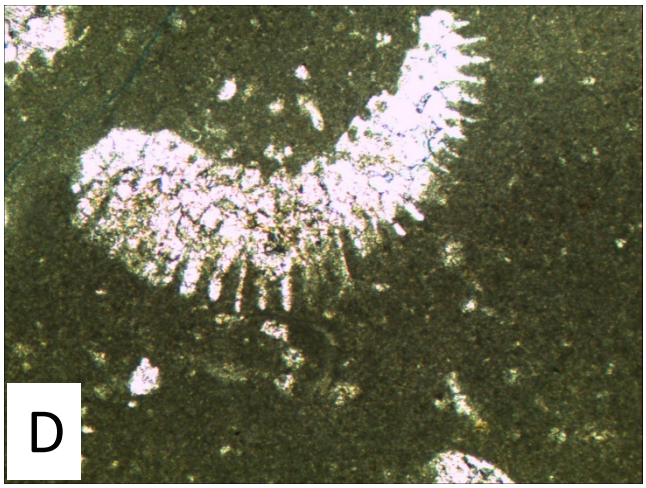
F. *Holosporella arabica* Granier and Brunn (1991), Well-B, 8365.1', field of view 6.3 mm.

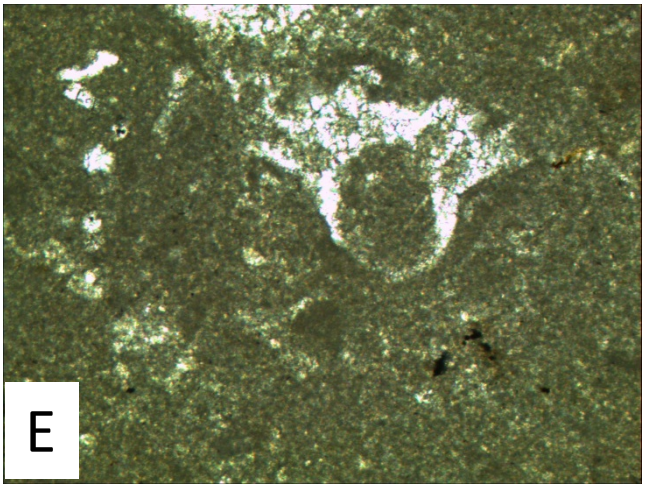
Plate 59











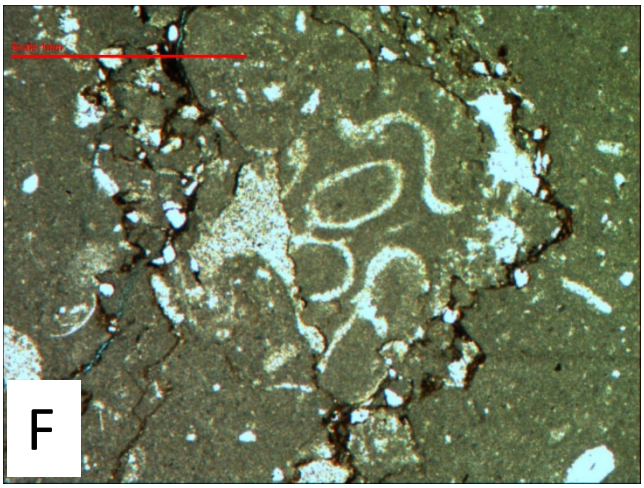


Plate 60

A. *Salpingoporella annulata* Carozzi (1953), Well-A, 4064.5', field of view 6.3 mm.

B. *Salpingoporella annulata* Carozzi (1953), Well-A, 4064.5', field of view 2.5 mm.

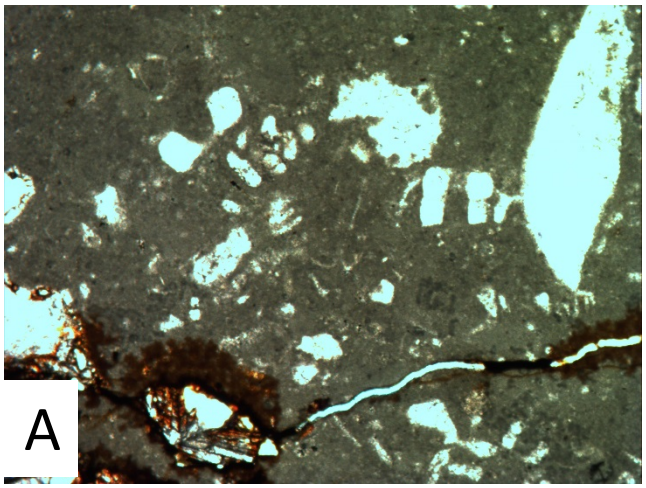
C. *Salpingoporella annulata* Carozzi (1953), Well-D, 8638.2', field of view 6.3 mm.

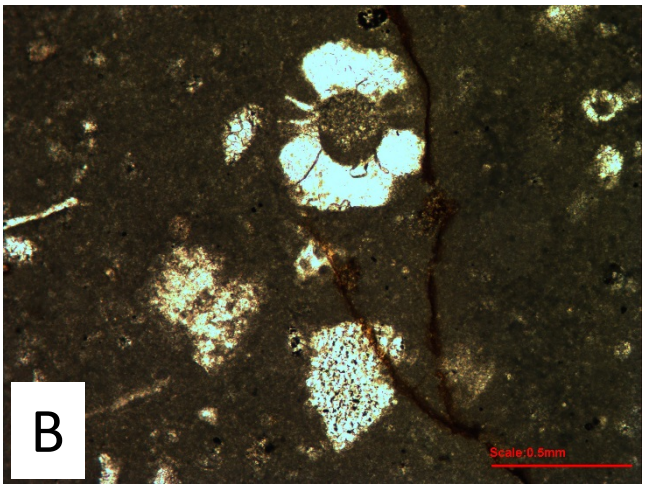
D. *Salpingoporella annulata* Carozzi (1953), Well-D, 8644.2', field of view 2.5 mm.

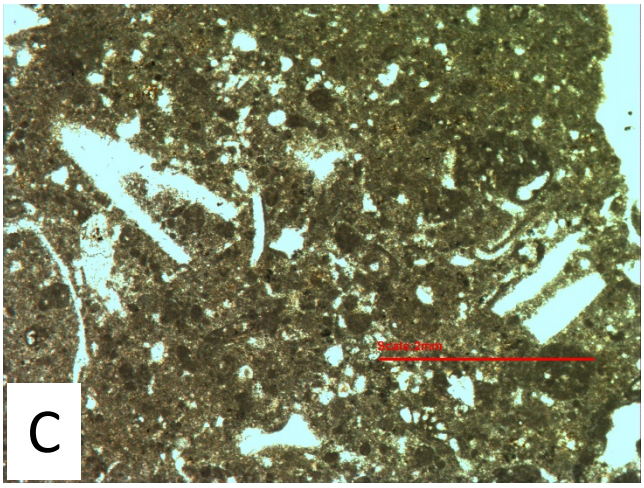
E. *Salpingoporella annulata* Carozzi (1953), Well-H, 7323.7', field of view 2.5 mm.

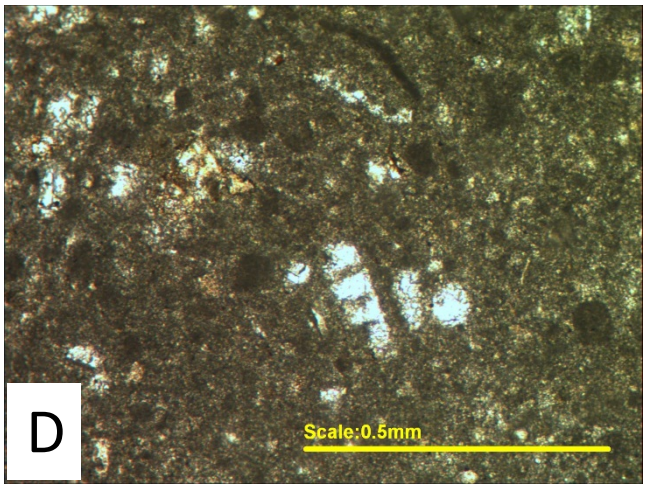
F. *Salpingoporella annulata* Carozzi (1953), Well-H, 6408.1', field of view 2.5 mm.

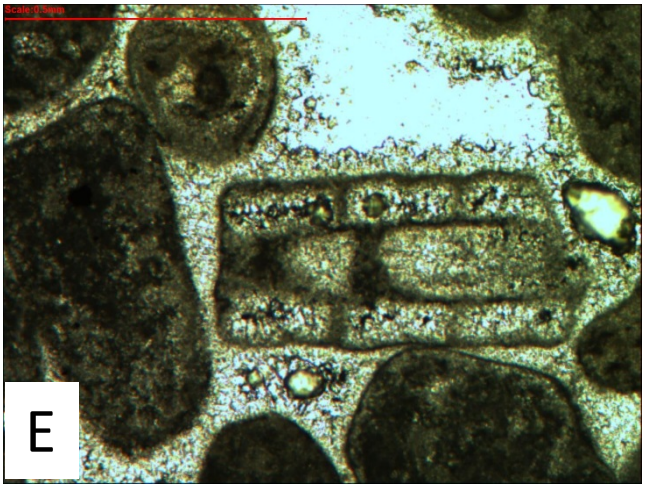
Plate 60











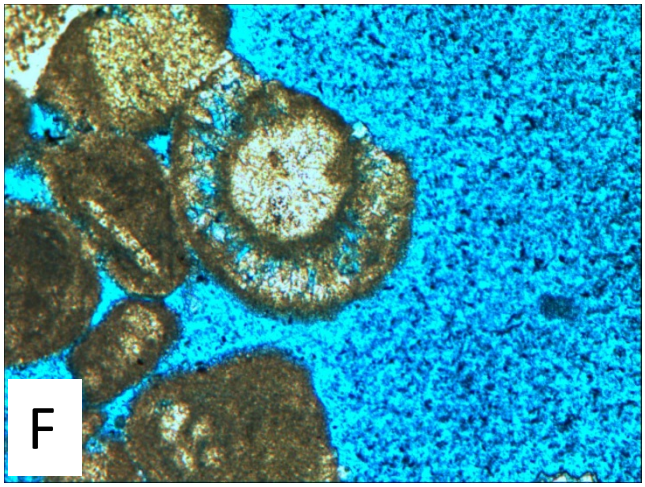


Plate 61

A. *Salpingoporella annulata* Carozzi (1953), Well-H, 7330.5', field of view 2.5 mm.

B. *Salpingoporella annulata* Carozzi (1953), Well-B, 8365.1', field of view 2.5 mm.

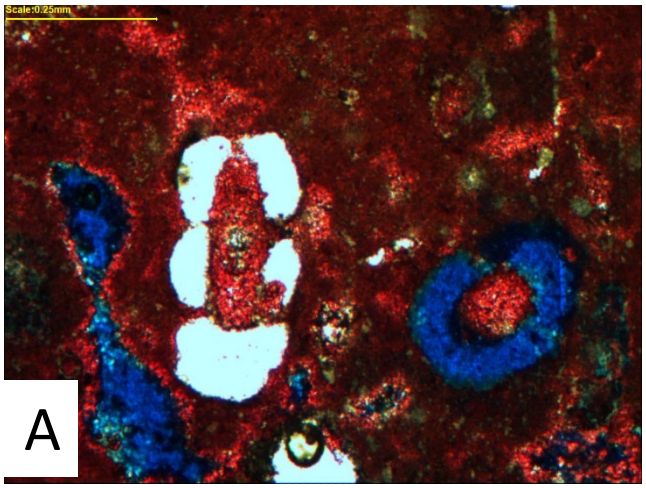
C. *Salpingoporella annulata* Carozzi (1953), Well-I, 5474.7', field of view 6.3 mm.

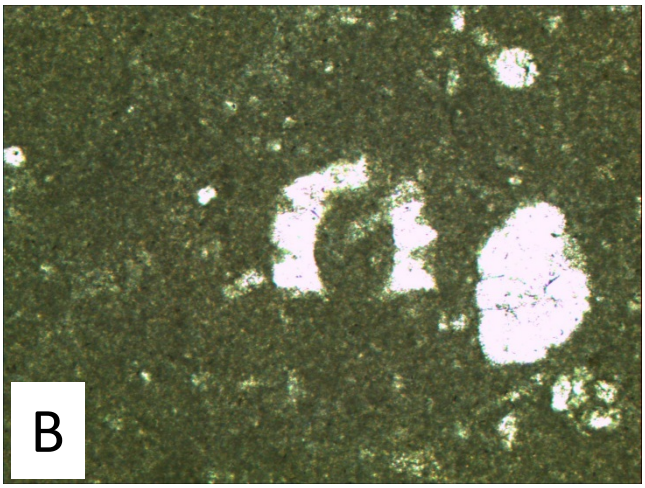
D. *Salpingoporella annulata* Carozzi (1953), Well-B, 8361.8', field of view 2.5 mm.

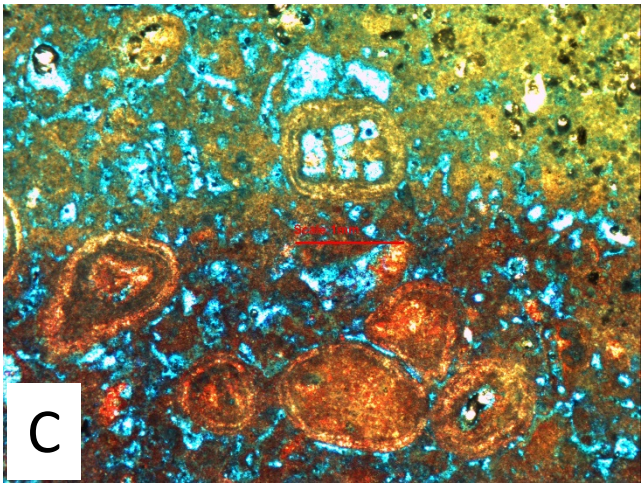
E. *Salpingoporella annulata* Carozzi (1953), with micrite envelope and micritization activity left by calcite cement, Well-H, 6414.8', field of view 2.5 mm.

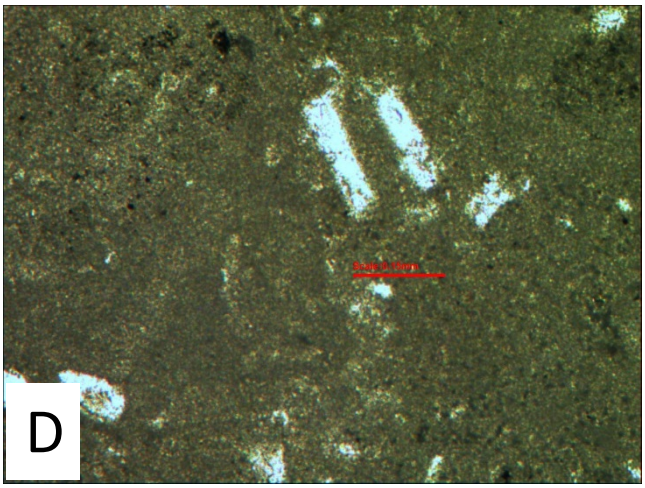
F. *Salpingoporella annulata* Carozzi (1953), with micrite envelope and micritization activity left by calcite cement, Well-H, 6414.8', field of view 2.5 mm.

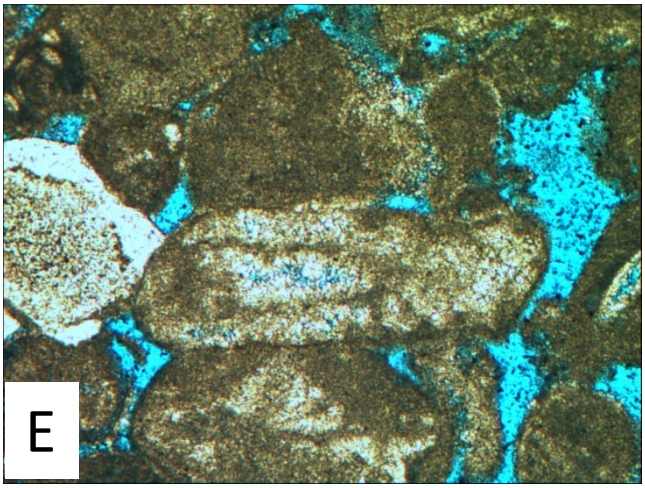
Plate 61











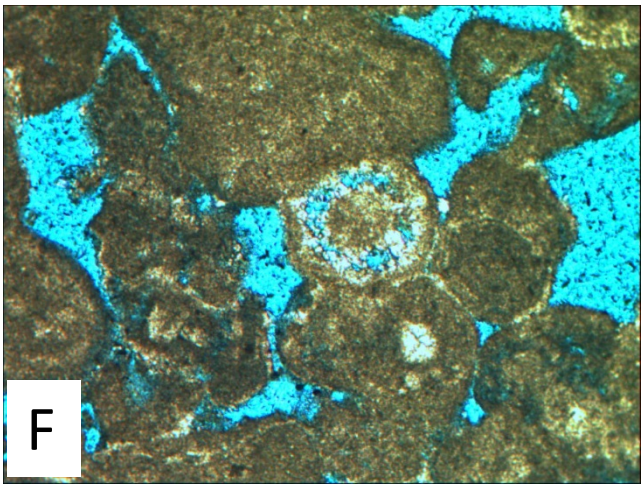


Plate 62

A. *Salpingoporella circassa* Farinacci and Radoičić (1991), Well-B, 8431.3', field of view 1.25 mm.

B. *Salpingoporella circassa* Farinacci and Radoičić (1991), Well-A, 4061.6', field of view 2.5 mm.

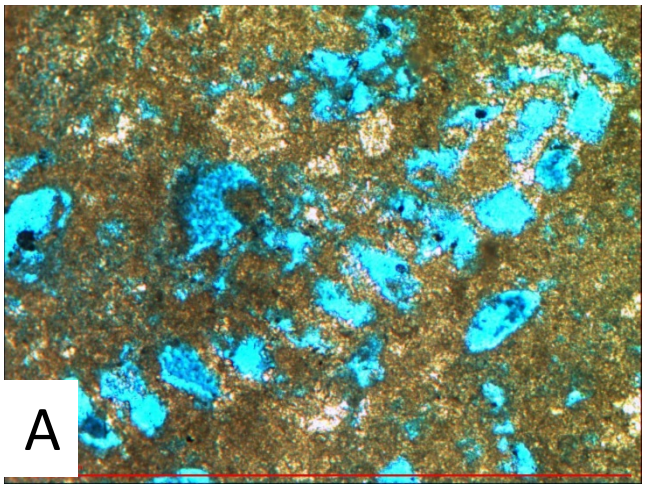
C. *Salpingoporella annulata* Carozzi (1953), Well-A, 4064.5', field of view 2.5 mm.

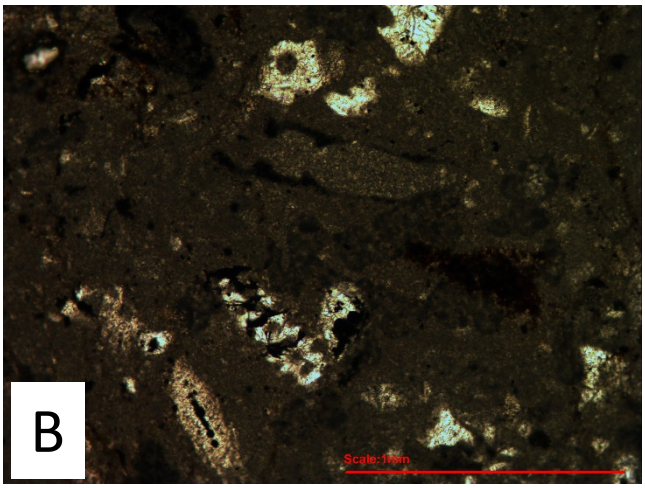
D. *Salpingoporella* ex gr*. pygmaea* (Gümbel, 1891), Well-G, 6760.6', field of view 2.5 mm.

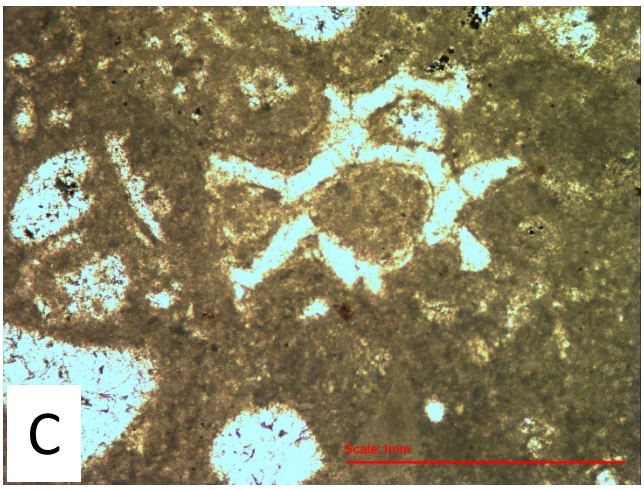
E. *Salpingoporella* ex gr*. pygmaea* (Gümbel, 1891), Well-G, 6760.6', field of view 2.5 mm.

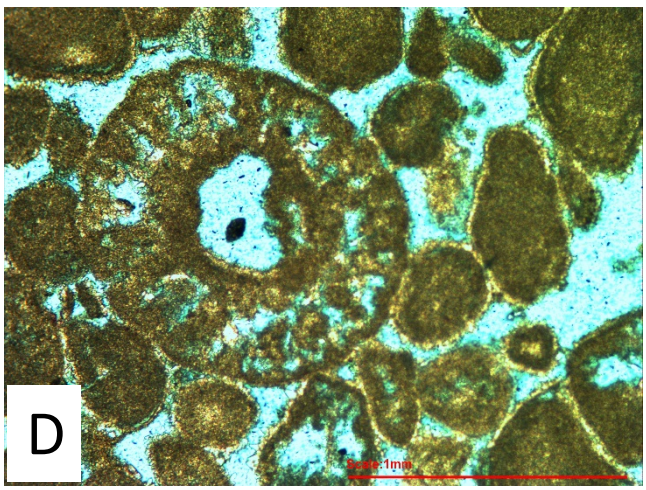
F. *Salpingoporella* ex gr*. pygmaea* (Gümbel, 1891), Well-G, 6767.5', field of view 2.5 mm.

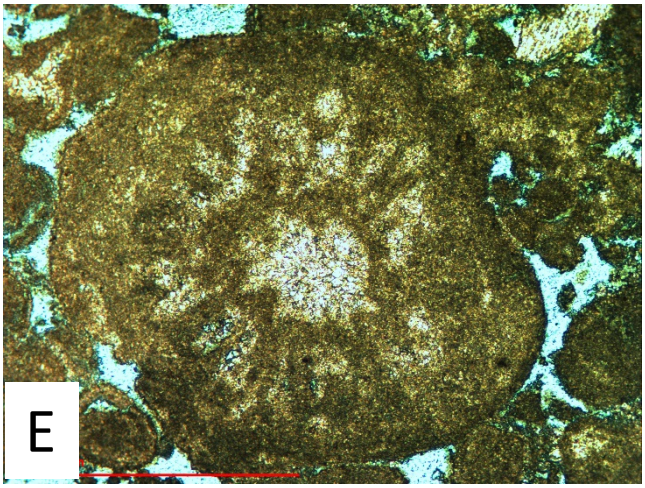
Plate 62











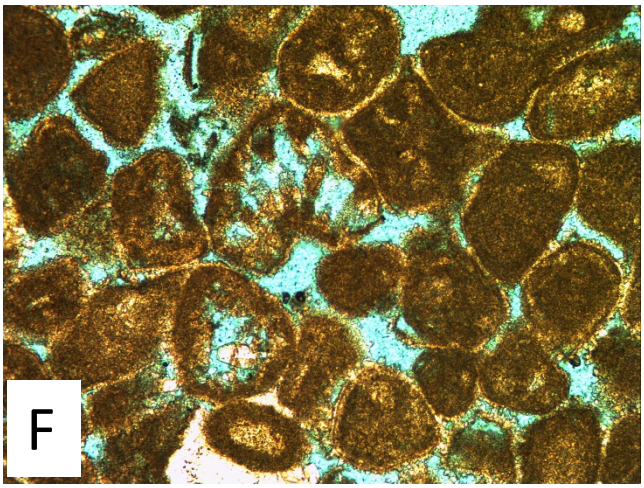
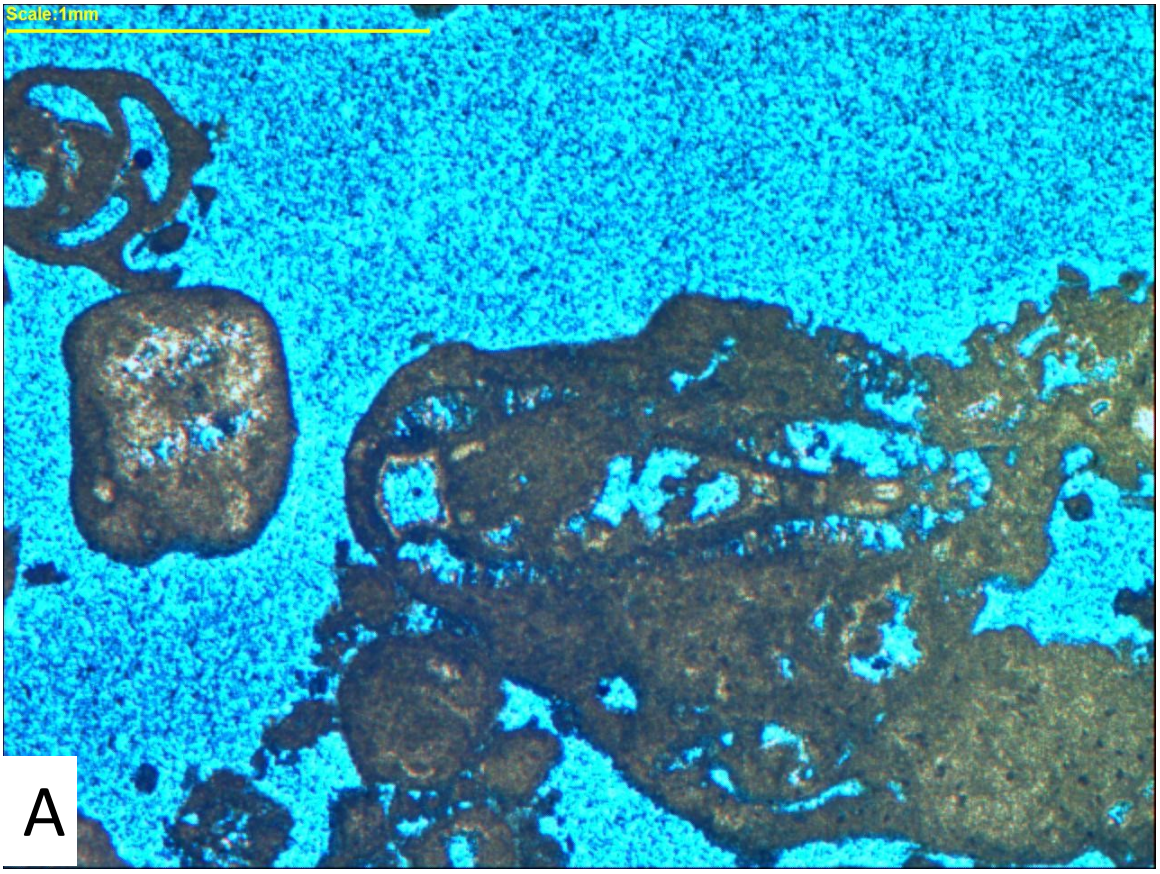


Plate 63

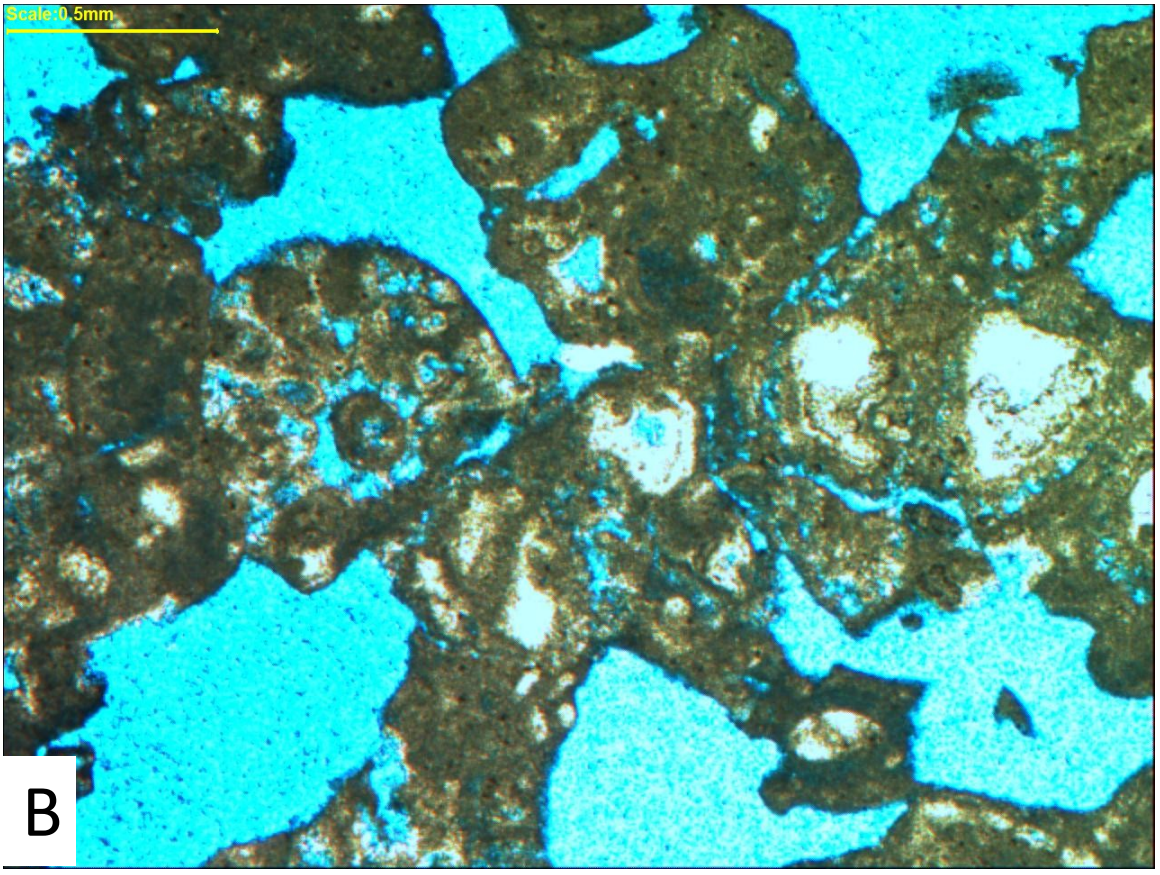
A. *Salpingoporella* ex gr*. pygmaea* (Gümbel, 1891), Well-H, 6217.5', field of view 2.5 mm.

B. *Salpingoporella* ex gr*. pygmaea* (Gümbel, 1891), Well-H, 6217.5', field of view 2.5 mm.

Plate 63



A



B

Plate 64

A. *Salpingoporella* ex gr*. pygmaea* (Gümbel, 1891), Well-G, 6779.5’, field of view 2.5 mm.

B. *Salpingoporella* ex gr*. pygmaea* (Gümbel, 1891), Well-G, 6779.5’, field of view 6.3 mm.

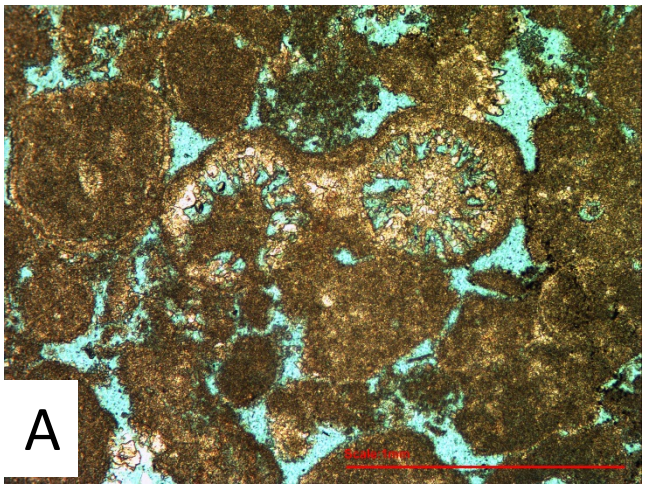
C. *Clypina isabellae* Masse *et al.* (1999), Well-H, 6410.2’, field of view 6.3 mm.

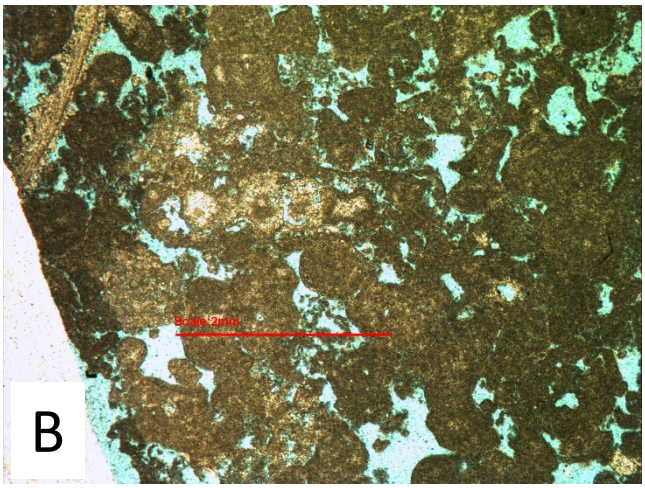
D. *Clypina isabellae* Masse *et al.* (1999), Well-H, 6422.5’, field of view 6.3 mm.

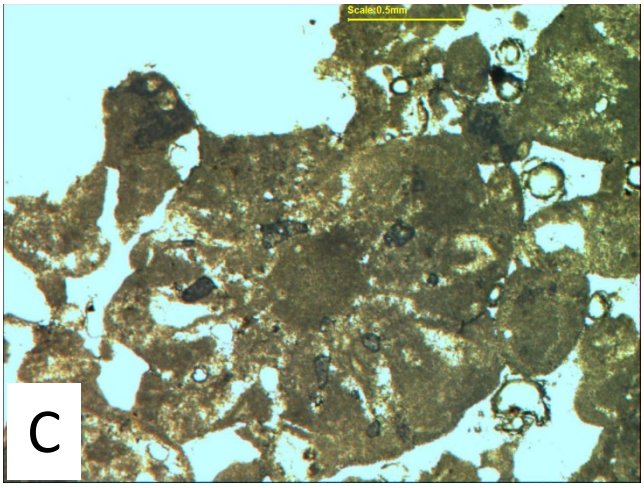
E. *Clypina isabellae* Masse *et al.* (1999), Well-A, 4064.5’, field of view 6.3 mm.

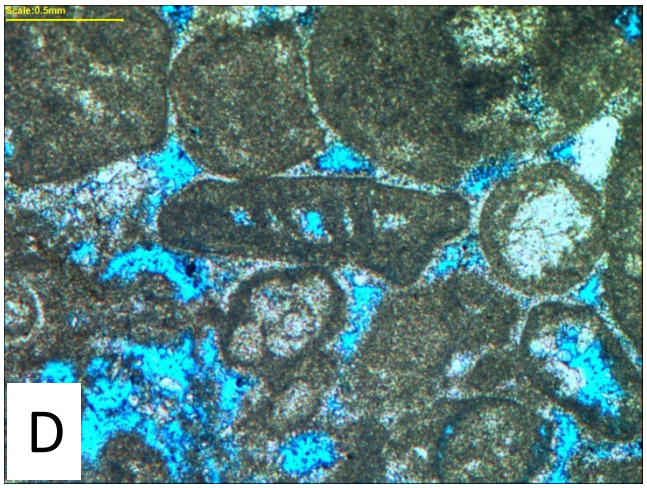
F. *Iranella inopinata* Gollestaneh (1965), Well-A, 4061.6’, field of view 2.5 mm.

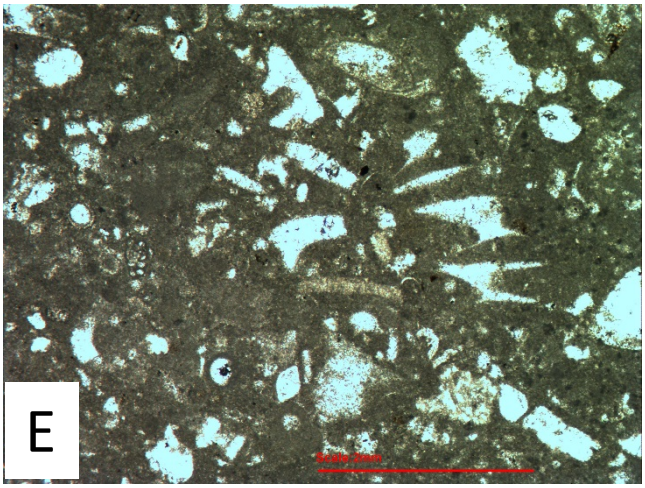
Plate 64











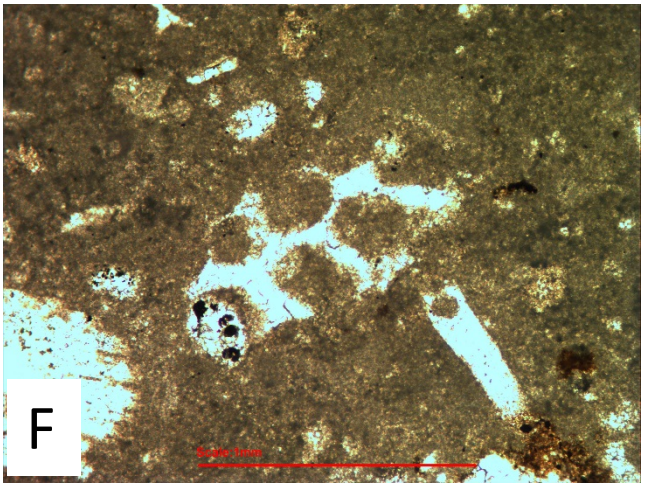


Plate 65

A. *Permocalculus ampullaceus* (P) Elliott (1959), Gastropod (G) and *Salpingoporella annulata* (S) Carozzi, Well-A, 4063.4', field of view 2.5 mm.

B. *Salpingoporella dinarica* Radoičić (1959), Well-G, 6768.5', field of view 6.3 mm.

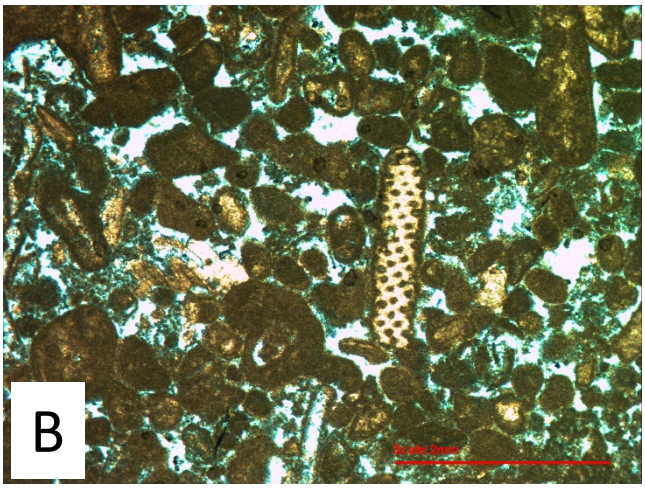
C. *Salpingoporella dinarica* Radoičić (1959), Well-H, 6423.5', field of view 6.3 mm.

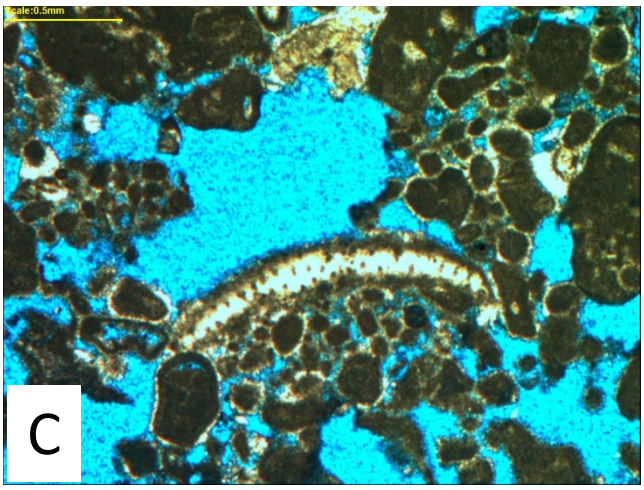
D. *Permocalculus ampullaceus* Elliott (1959), Well-H, 6410.2', field of view 2.5 mm.

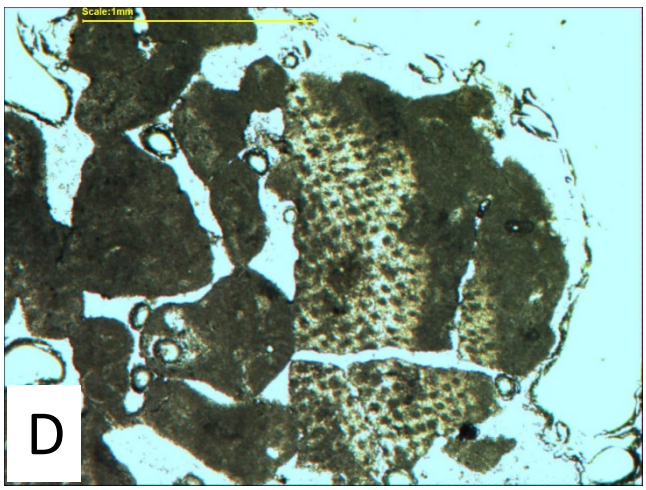
E. *Permocalculus ampullaceus* Elliott (1959), Well-B, 8357', field of view 6.3 mm.

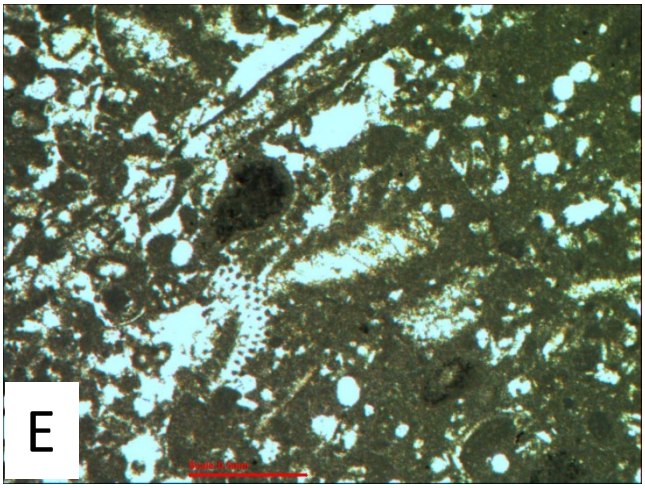
F. *Permocalculus ampullaceus* Elliott (1959), Well-B, 8375.9', field of view 6.3 mm.

Plate 65









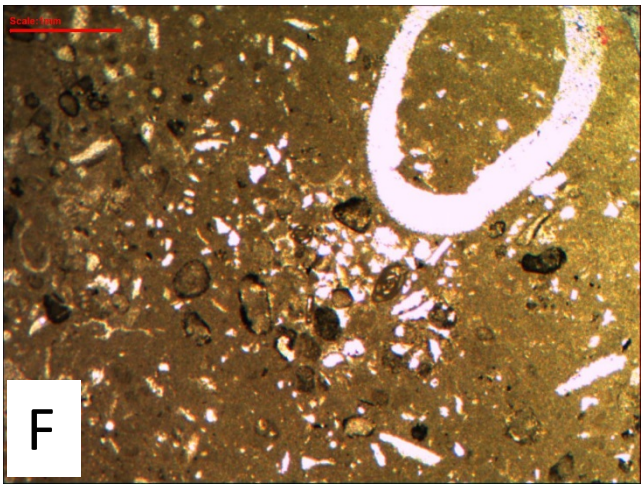


Plate 66

A. *Salpingoporella dinarica* Radoičić (1959), Well-I, 5524.2', field of view 2.5 mm.

B. *Thaumatoporella parvovesiculifera* (Raineri, 1922), Well-G, 6760.6', field of view 2.5 mm.

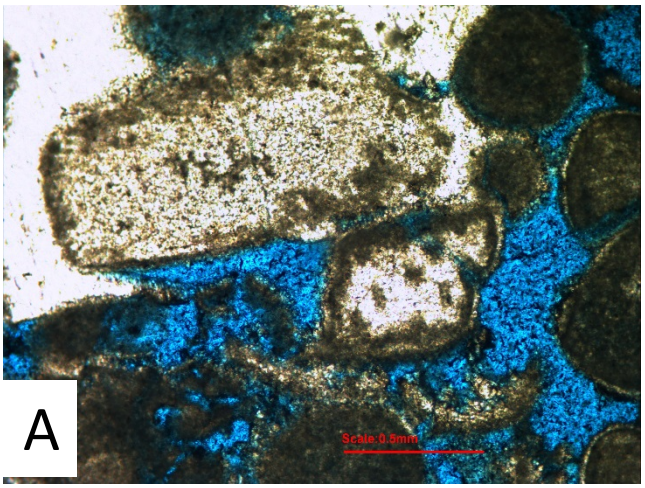
C. *Thaumatoporella parvovesiculifera* (Raineri, 1922), Well-G, 6767.5', field of view 2.5 mm.

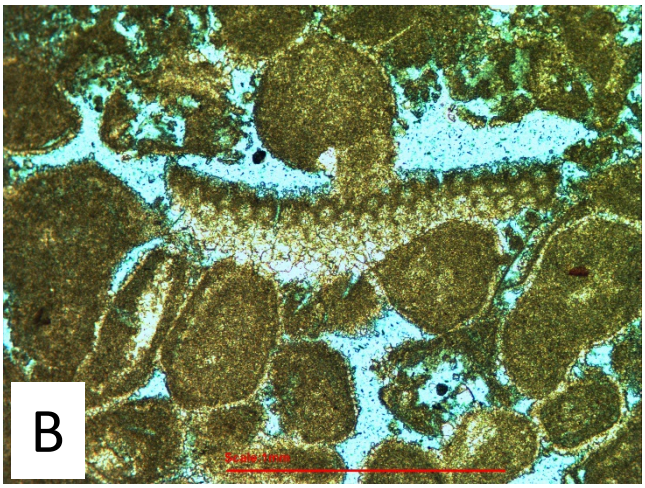
D. *Thaumatoporella parvovesiculifera* (Raineri, 1922), Well-H, 6416.5', field of view 2.5 mm.

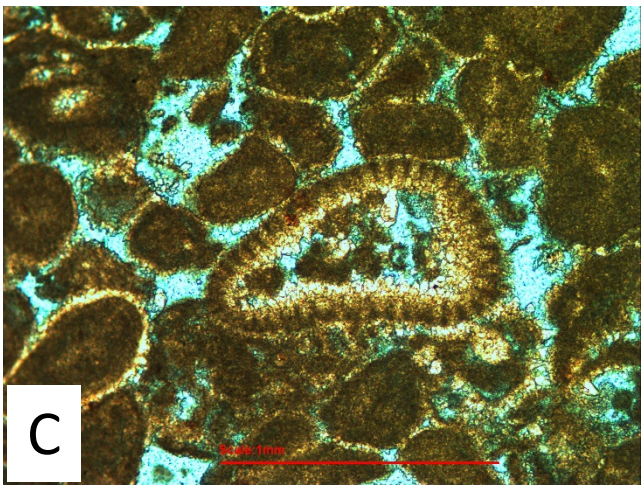
E. *Arabicodium aegagrapiloides* Elliott (1957), Well-H, 6407.2', field of view 6.3 mm.

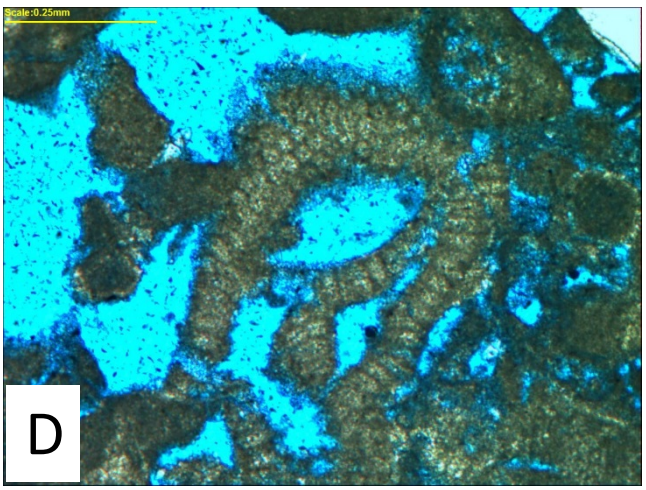
F. *Marinella lugeoni* Pfender (1939), Well-H, 6407.2', field of view 6.3 mm.

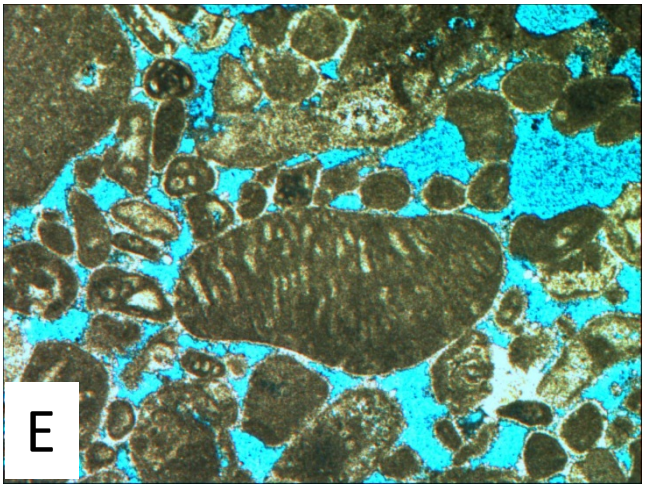
Plate 66











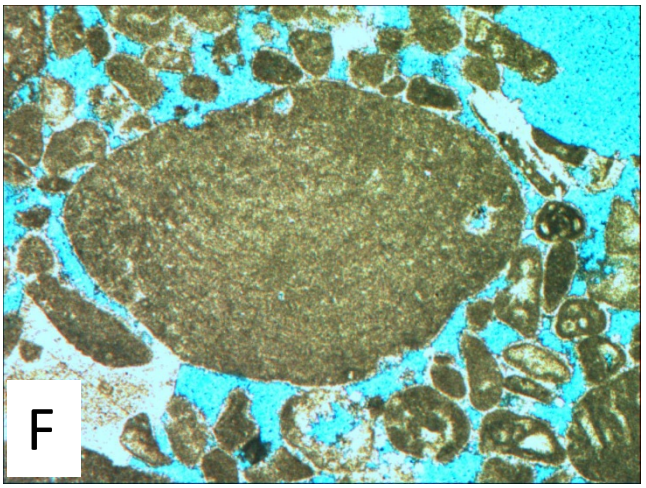


Plate 67

A. *Aeolisaccus dunningtoni* Elliott (1958), Well-B, 8429.3', field of view 2.5 mm.

B. *Aeolisaccus dunningtoni* Elliott (1958), Well-H, 7328.6', field of view 1.25 mm.

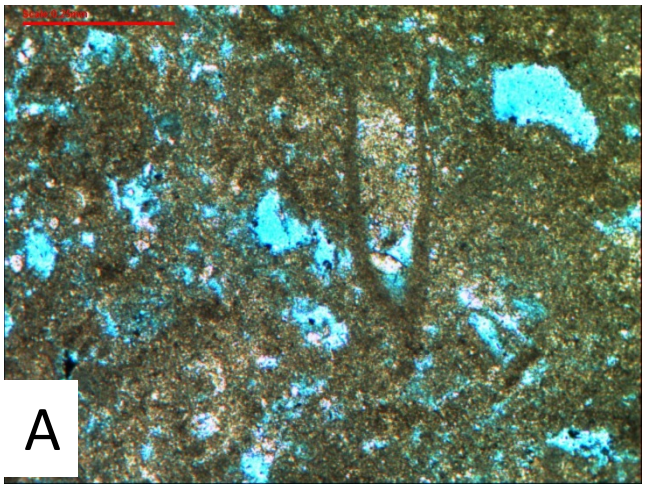
C. *Aeolisaccus dunningtoni* Elliott (1958), Well-H, 7316.2', field of view 2.5 mm.

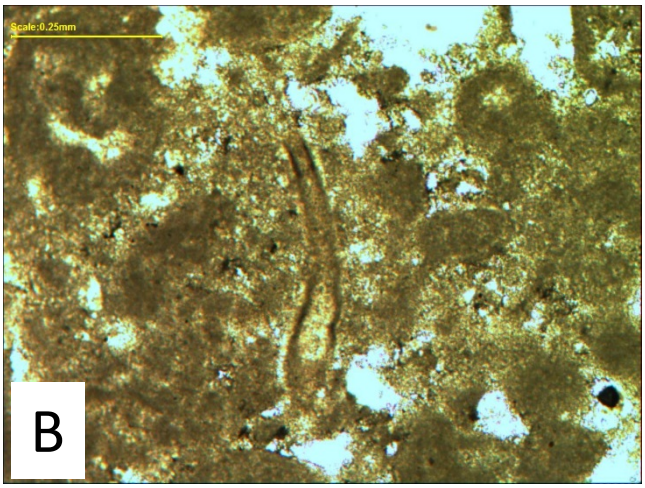
D. *Aeolisaccus dunningtoni* Elliott (1958), Well-G, 6775.6', field of view 2.5 mm.

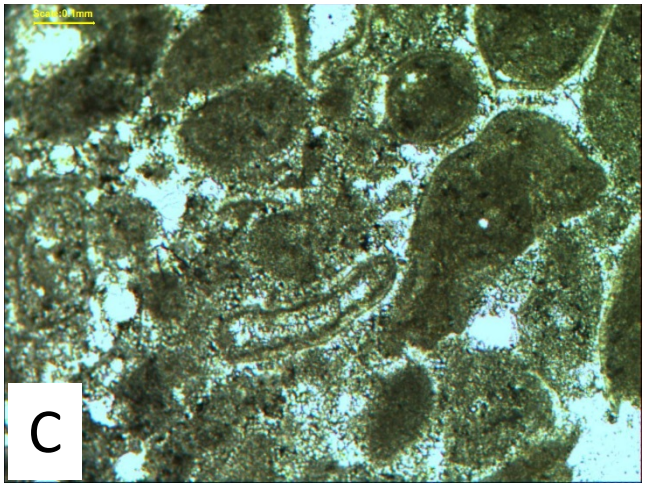
E. *Aeolisaccus dunningtoni* Elliott (1958), Well-D, 8644.2', field of view 2.5 mm.

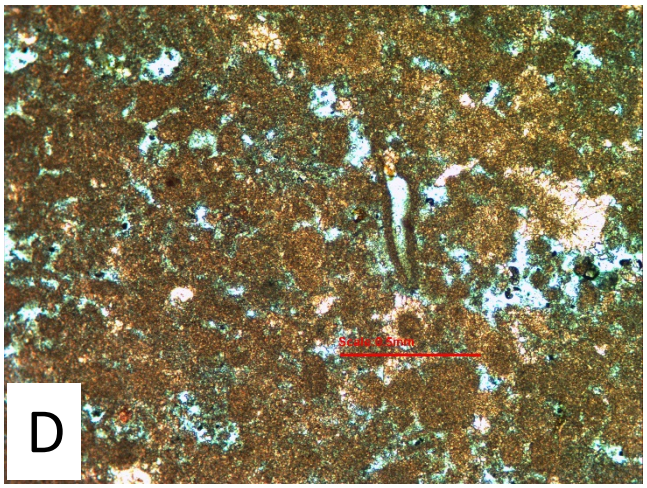
F. *Aeolisaccus dunningtoni* Elliott (1958), Well-B, 8410.5', field of view 1.25 mm.

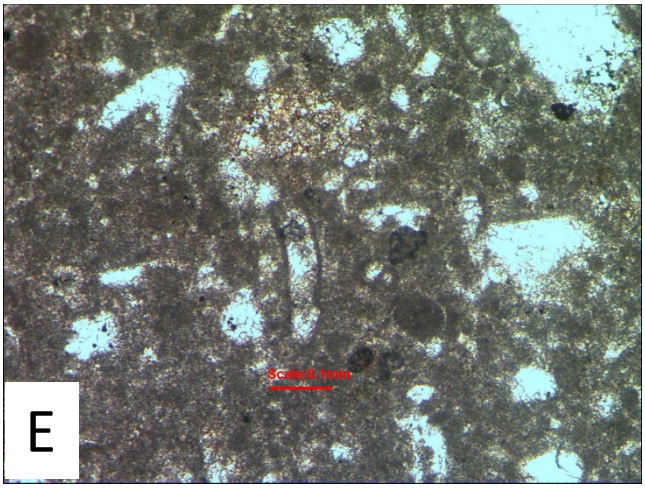
Plate 67











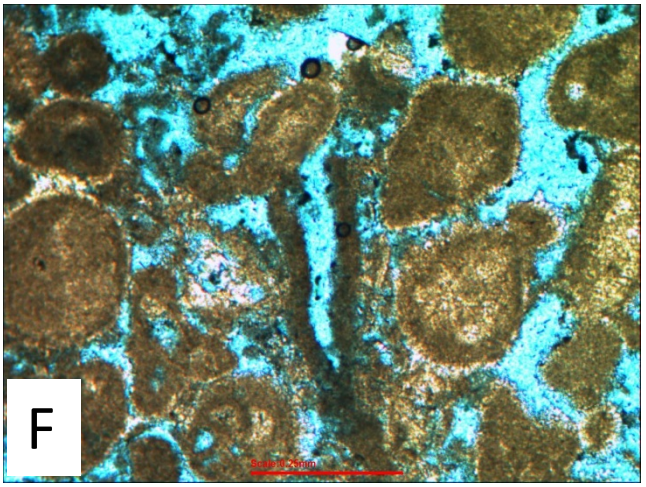


Plate 68

A. *Hensonella* sp., Well-G, 6760.6', field of view 6.3 mm.

B. *Hensonella* sp., Well-G, 6809.5', field of view 2.5 mm.

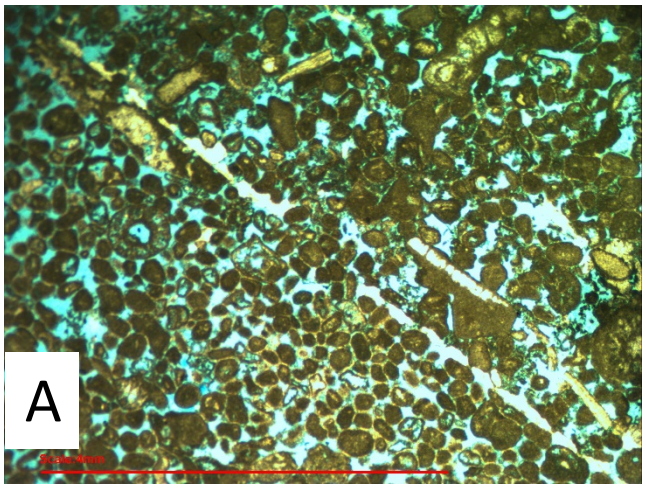
C. *Hensonella* sp., Well-G, 6811.3', field of view 2.5 mm.

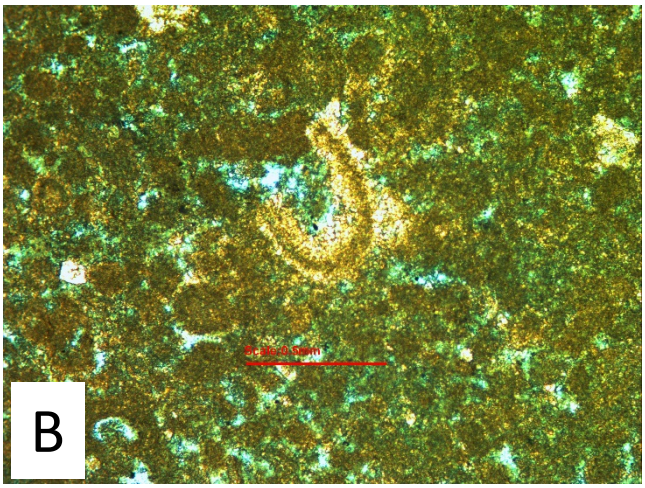
D. *Lithocodium aggregatum* Elliott (1956), encrusting type surrounding and micritizing a multi-layered bivalve, Well-G, 6761.3', field of view 6.3 mm.

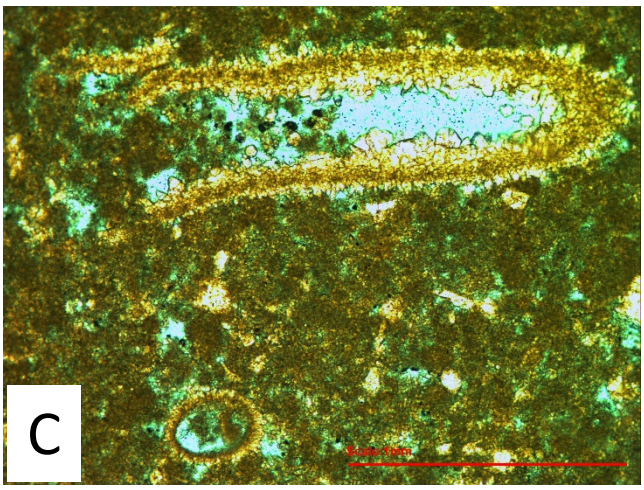
E. *Lithocodium aggregatum* Elliott (1956), encrusting type surrounding and micritizing a multi-layered bivalve, Well-G, 6761.3', field of view 6.3 mm.

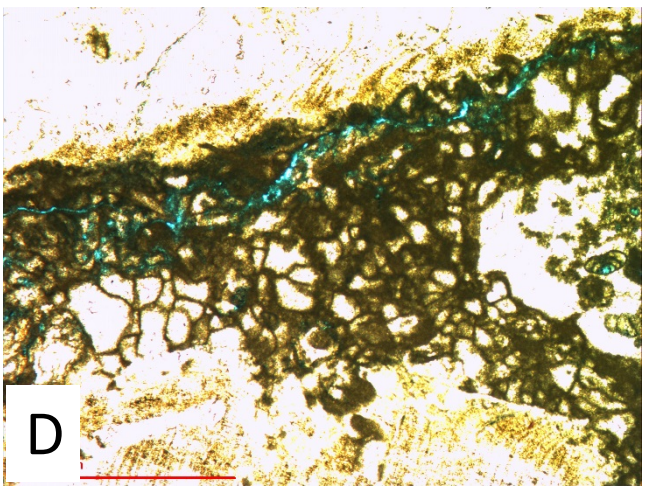
F. *Lithocodium aggregatum* Elliott (1956), encrusting type surrounding and micritizing a multi-layered bivalve, Well-G, 6761.3', field of view 6.3 mm.

Plate 68









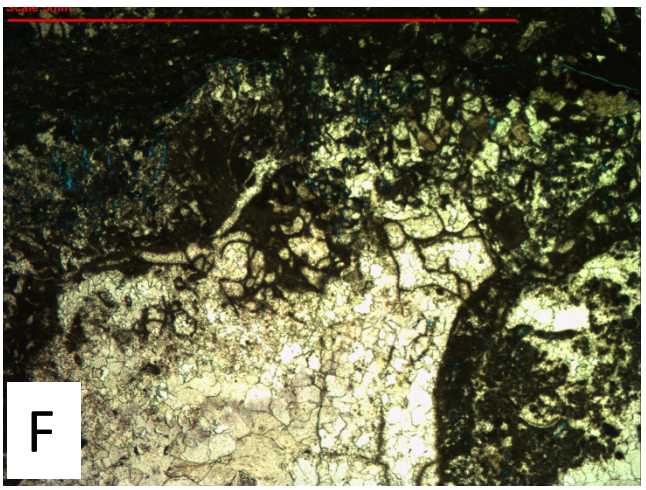


Plate 69

A. *Lithocodium aggregatum* Elliott (1956), encrusting type surrounding and micritizing a multi-layered bivalve, Well-G, 6761.3', field of view 6.3 mm.

B. *Lithocodium aggregatum* Elliott (1956), encrusting type surrounding and micritizing a multi-layered bivalve, Well-G, 6761.3', field of view 6.3 mm.

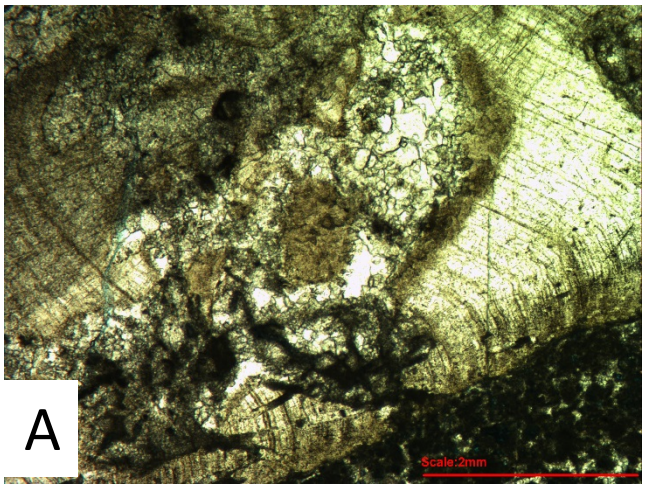
C. *Lithocodium aggregatum* Elliott (1956), large, encrusting oncoidal type, mesh-like structure, Well-I, 5531.7', field of view 6.3 mm.

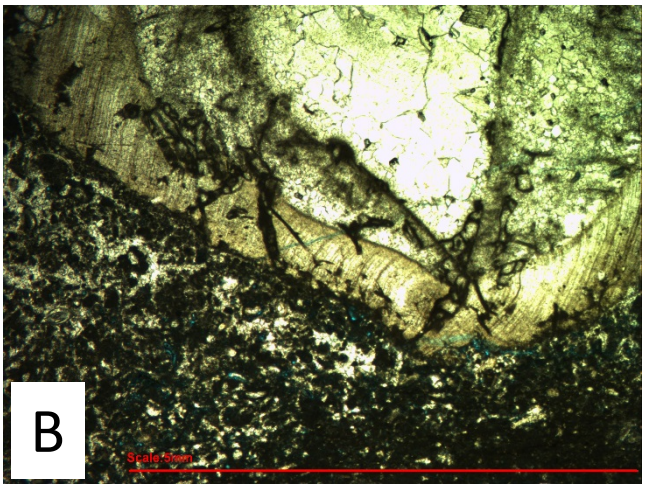
D. *Lithocodium aggregatum* Elliott (1956), large, encrusting type surrounding and micritizing a coral, miesh-like structure, Well-H, 6420.6', field of view 6.3 mm.

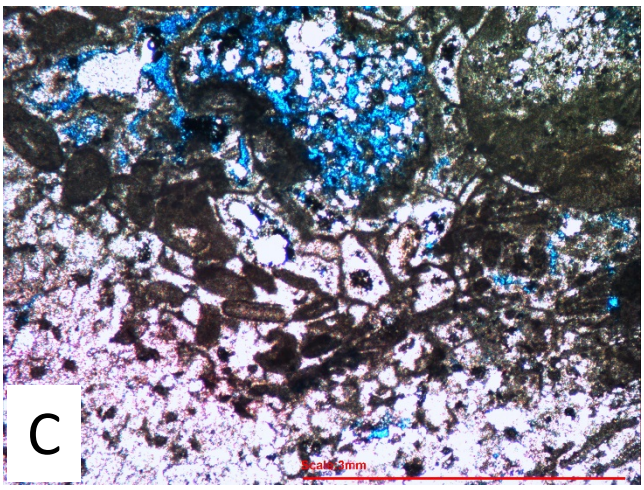
E. *Lithocodium aggregatum* Elliott (1956), large, encrusting oncoidal type, mesh-like structure, Well-F, 8402.5', field of view 6.3 mm.

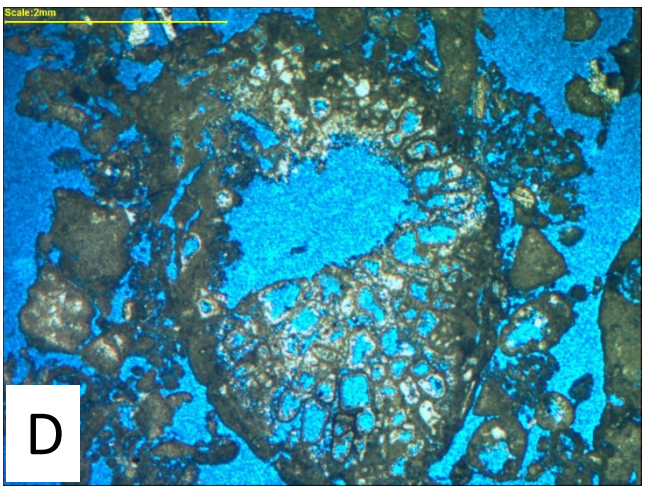
F. *Lithocodium aggregatum* Elliott (1956), encrusting type surrounding and micritizing a hard lithoclast, mesh-like structure, Well-G, 6761.3', field of view 6.3 mm.

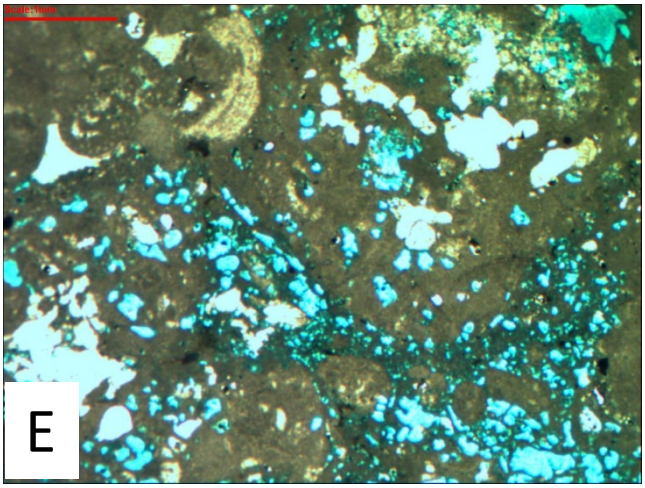
Plate 69











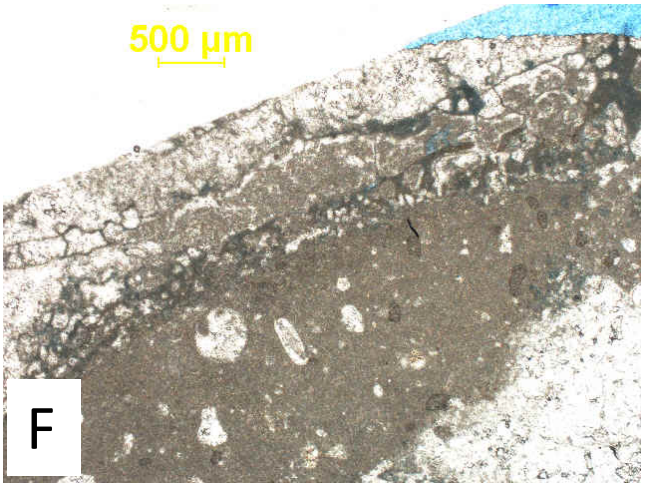


Plate 70

A. *Lithocodium aggregatum* Elliott (1956), Boundstone, Well-G, 6768.5', image maximum width is16 mm.

B. *Lithocodium aggregatum* Elliott (1956), with mesh-like structure, Well-I, 6411.1', field of view 6.3 mm.

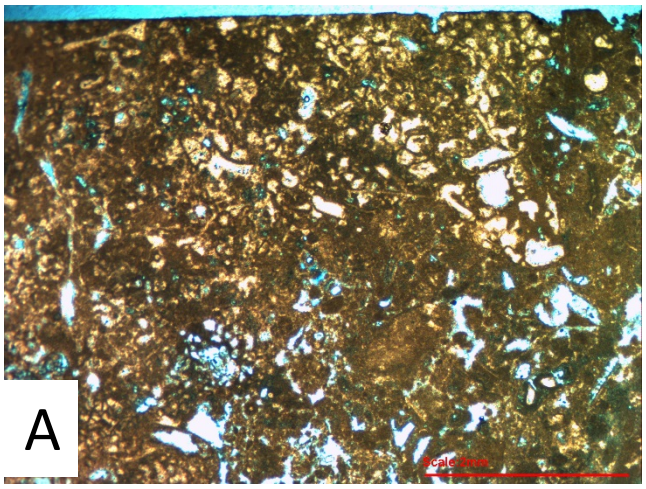
C. *Lithocodium aggregatum* Elliott (1956), a small lump of *lithocodium* oncoid, less than 1mm, Well-I, 6416.5', field of view 6.3 mm.

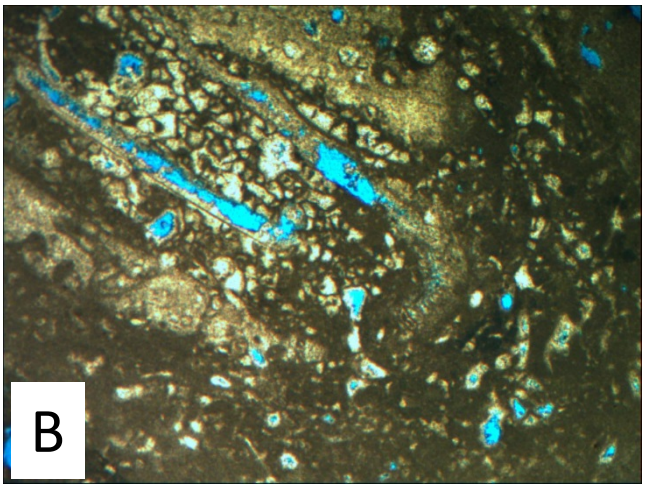
D. *Lithocodium aggregatum* Elliott (1956), large oncoidal type, over 2mm, Well-I, 6427.5', field of view 6.3 mm.

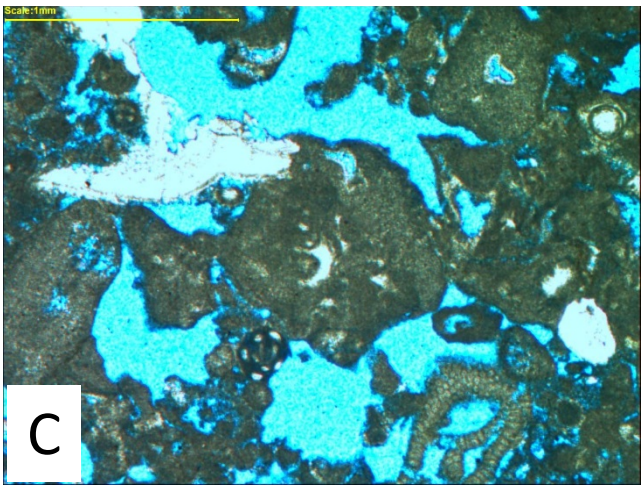
E. *Lithocodium aggregatum* Elliott (1956), large oncoidal type, over 2mm, common with mesh-like structures Well-I, 6427.5', field of view 6.3 mm.

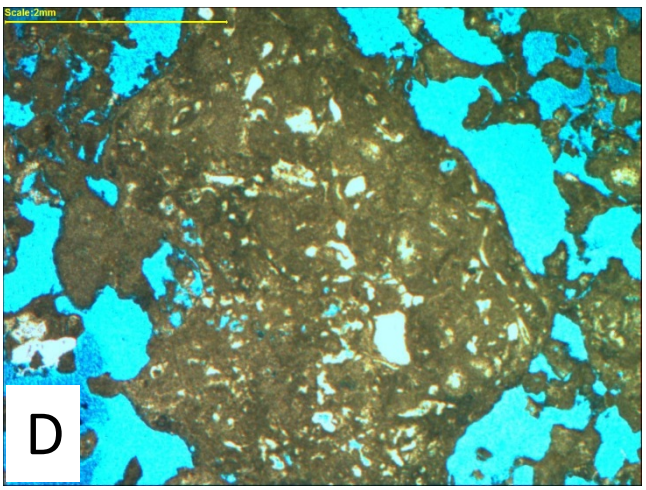
F. *Lithocodium aggregatum* Elliott (1956), large oncoidal type, over 2mm, , Well-F, 8423.5', field of view 6.3 mm.

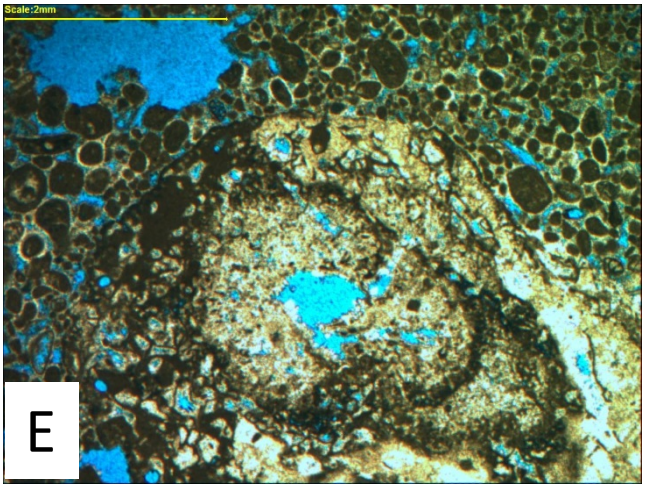
Plate 70











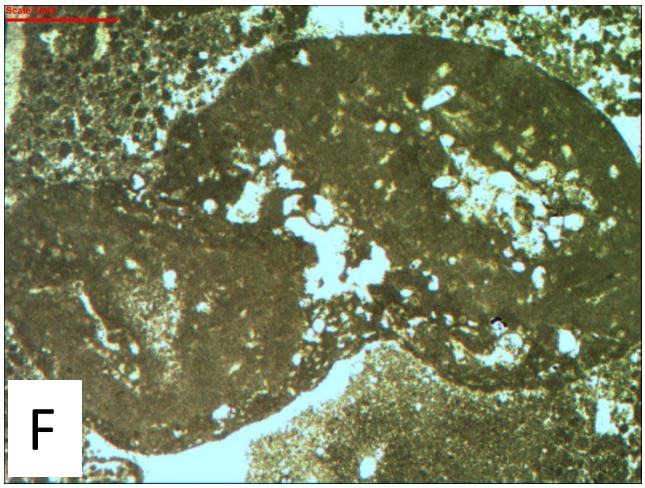


Plate 71

A. *Lithocodium aggregatum* Elliott (1956), Boundstone, Well-F, 8423.5', field of view 6.3 mm.

B. *Lithocodium aggregatum* Elliott (1956), Well-I, 6411.1', field of view 6.3 mm.

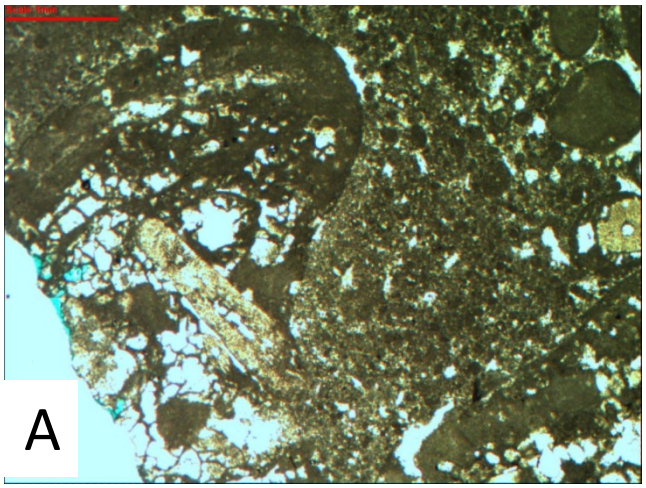
C. *Lithocodium aggregatum* Elliott (1956) in wackestone matrix, Well-F, 8469.5', field of view 6.3 mm.

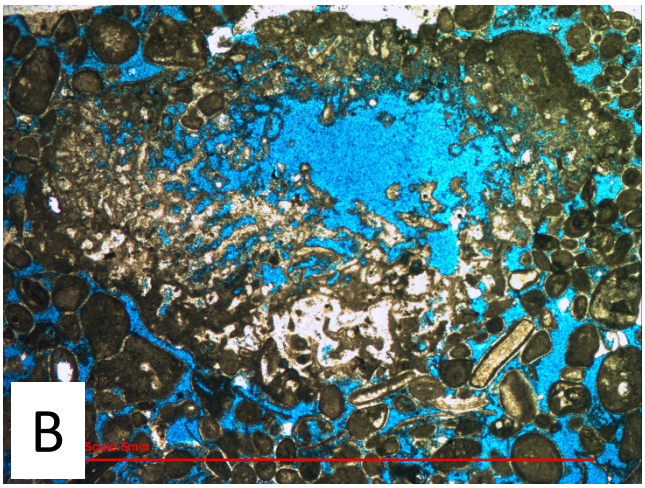
D. *Lithocodium aggregatum* Elliott (1956), encrusting a bivalve and a mold of ex-aragonitic, could be coral (see coralline form like lower corner), Well-D, 8015.2', field of view 6.3 mm.

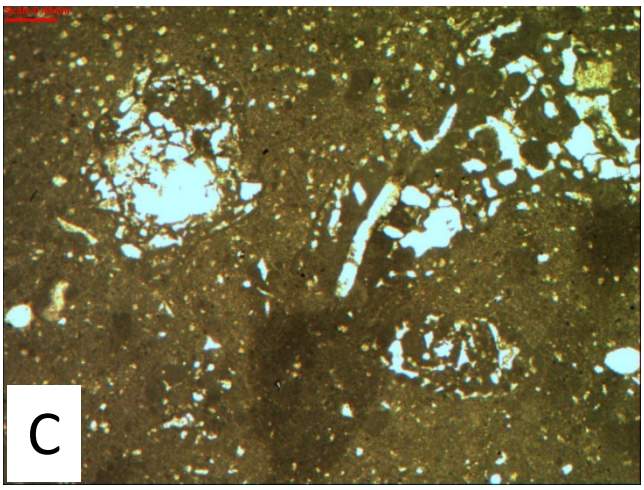
E. *Lithocodium aggregatum* Elliott (1956), encrusting oncoidal type, over 2mm, common with mish-like structures Well-H, 6406.4', field of view 6.3 mm.

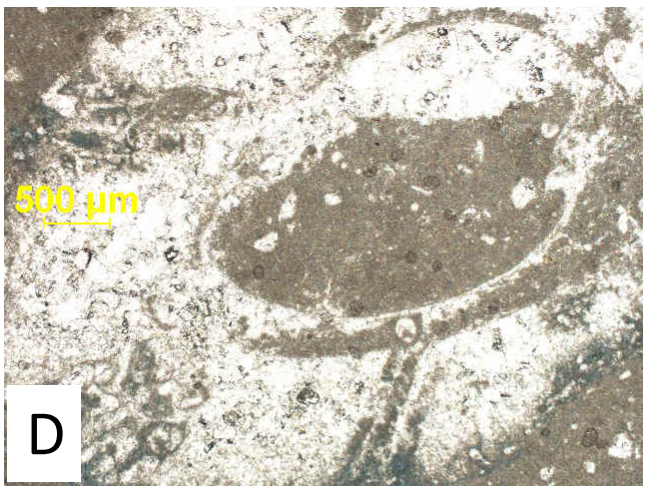
F. *Lithocodium aggregatum* Elliott (1956), large nodule type, over 2mm, , Well-G, 6760.6', field of view 6.3 mm.

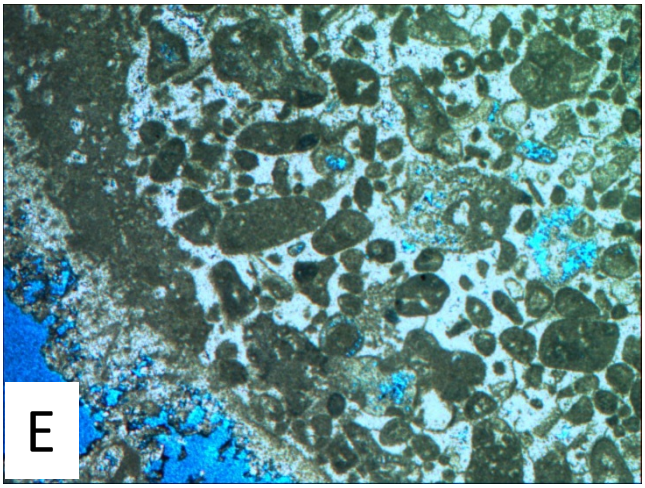
Plate 71











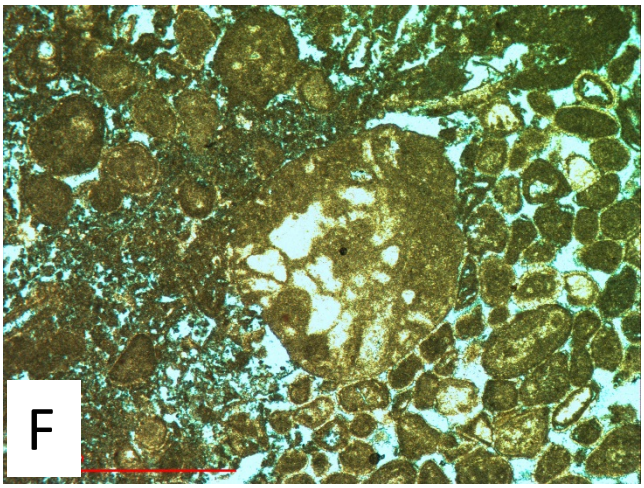


Plate 72

A. *Pseudolithocodium carpathicum* Míšík (1979), Well-G, 6811.3', field of view 6.3 mm.

B. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-H, 6417.5', field of view 2.5 mm.

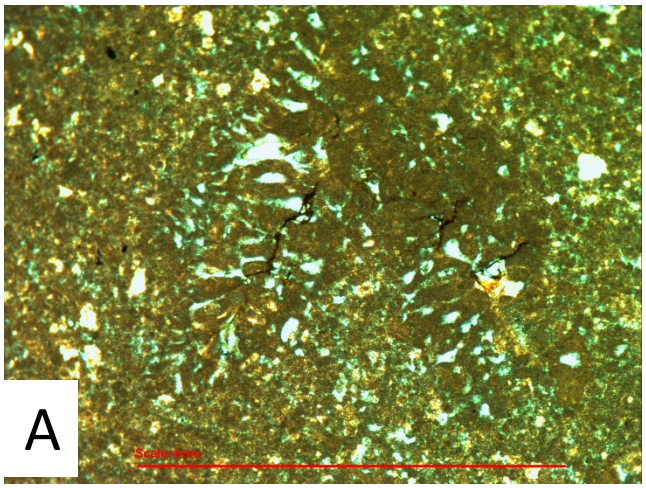
C. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-H, 6417.5', field of view 2.5 mm.

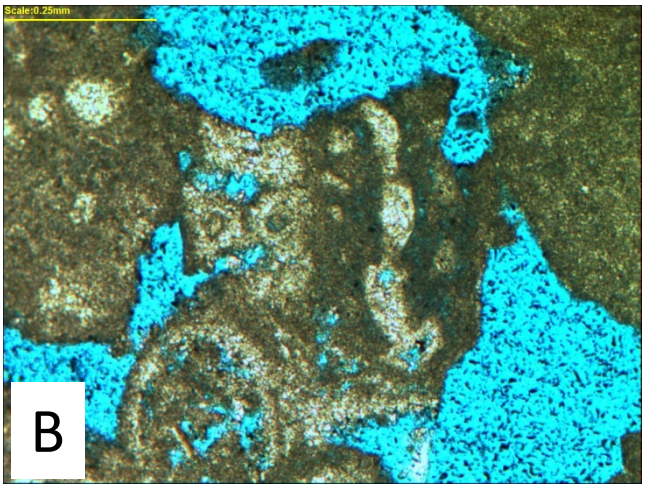
D. *Crescentiella morronensis* forma *morronensis* (Crescenti,1969), emend. Senowbari-Daryan *et al*. (2007), Well-H, 6417.5', field of view 2.5 mm.

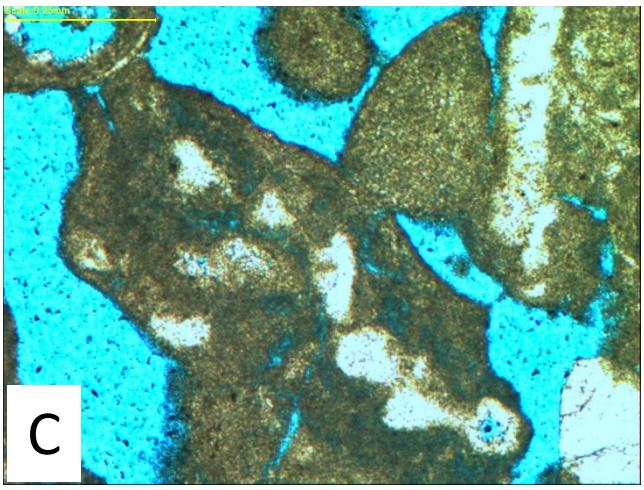
E. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-H, 6417.5', field of view 2.5 mm.

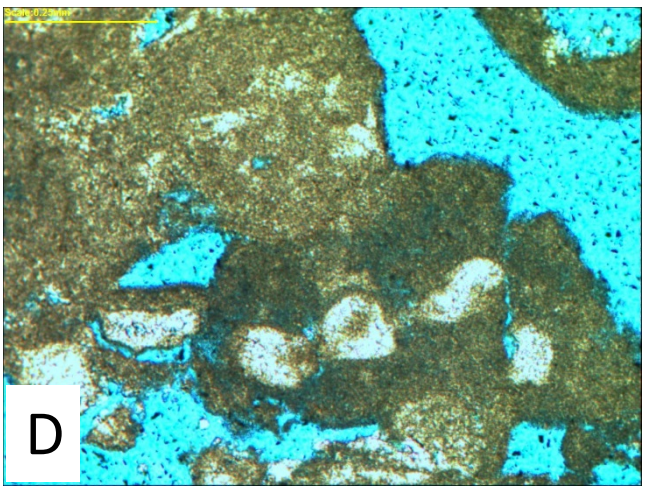
F. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-H, 6417.5', field of view 2.5 mm.

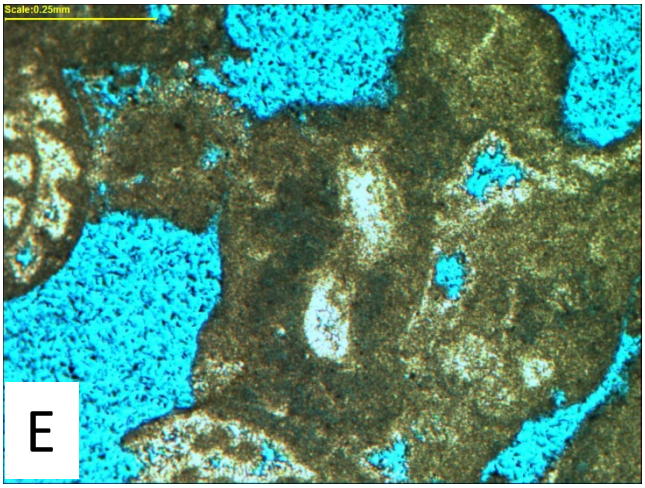
Plate 72











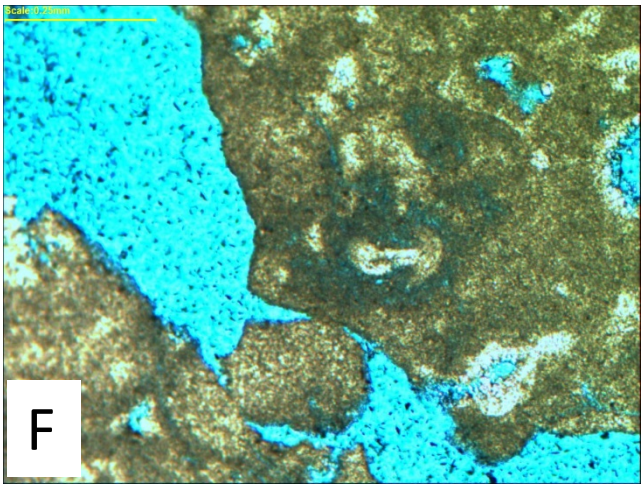


Plate 73

A. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*., 2007, Well-H, 6417.5’ , field of view 2.5 mm.

B. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-B, 8357’, field of view 6.3 mm.

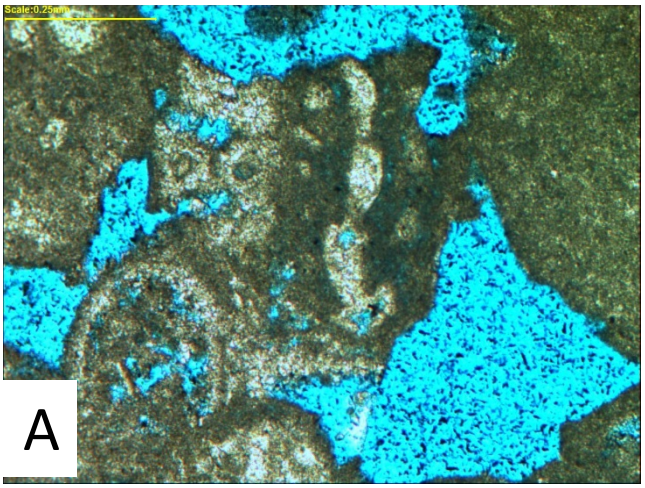
C. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-B, 8361.8’, field of view 6.3 mm.

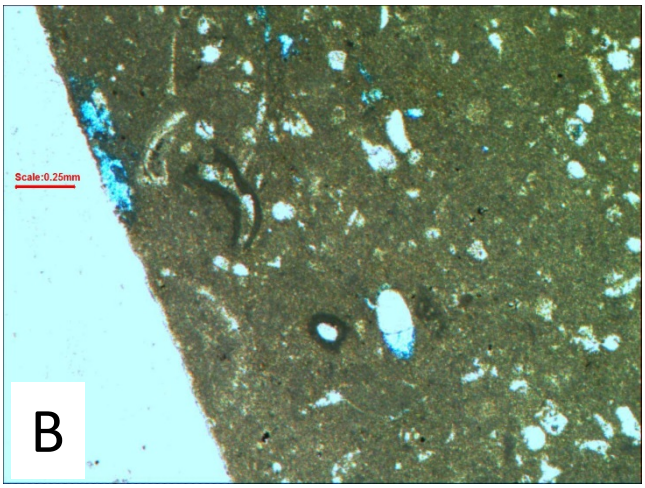
D. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-B, 8444.4’, field of view 6.3 mm.

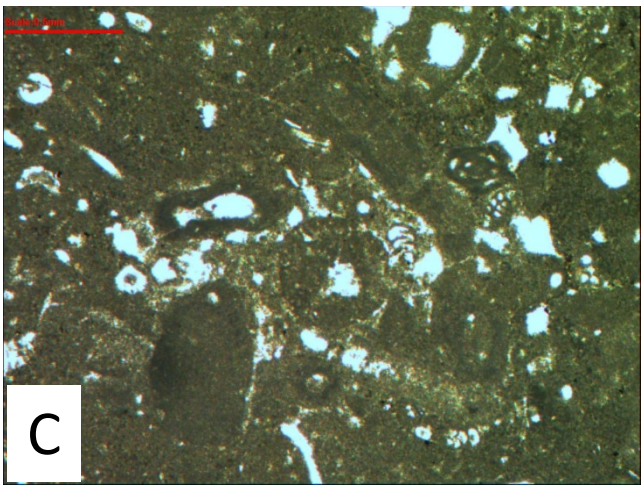
E. *Crescentiella morronensis* forma *morronensis* (Crescenti, 1969), emend. Senowbari-Daryan *et al*. (2007), Well-B, 8444.4’, field of view 6.3 mm.

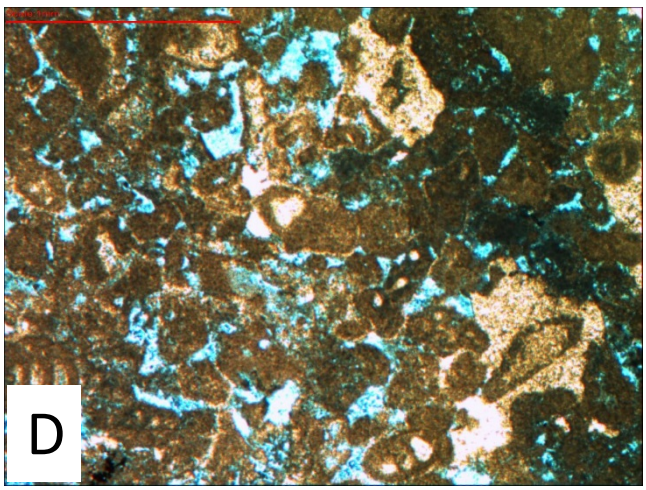
F. *Calpionellopsis simplex* (Colom, 1938.), Width (W) 0.08 mm, length (L) 0.14 mm, Well-D, 8638.2’, field of view 2.5 mm.

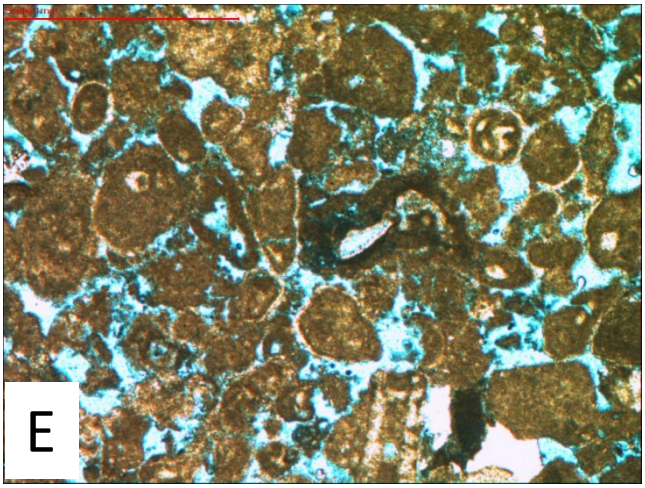
Plate 73











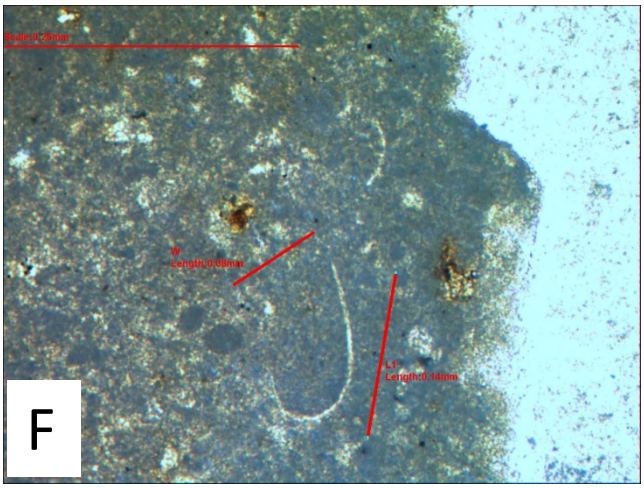


Plate 74

A. *Crassicollaria brevis* Remane (1962), Width (W) 0.1 mm, length (L) 0.12 mm, Well-D, 8609.7', field of view 1.25 mm.

B. *Calpionella alpina* Lorenz (1902), Well-D, 8627.7', field of view 2.5 mm.

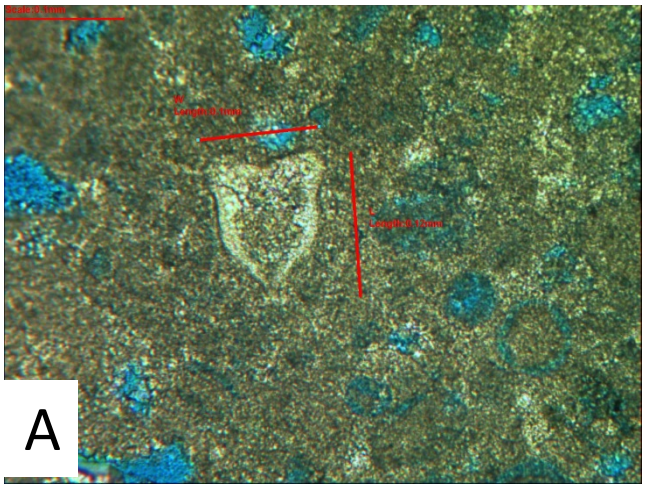
C. *Calpionella alpina* Lorenz (1902), Well-F, 8202.5', field of view 2.5 mm.

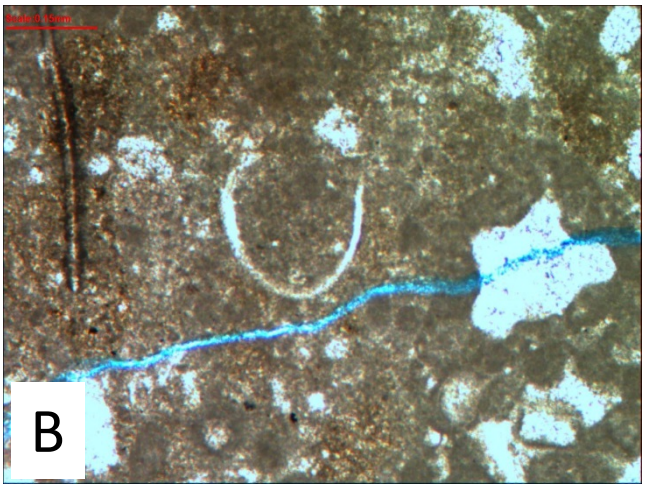
D. Serpulid sp., Well-I, 5531.7, field of view 6.3 mm.

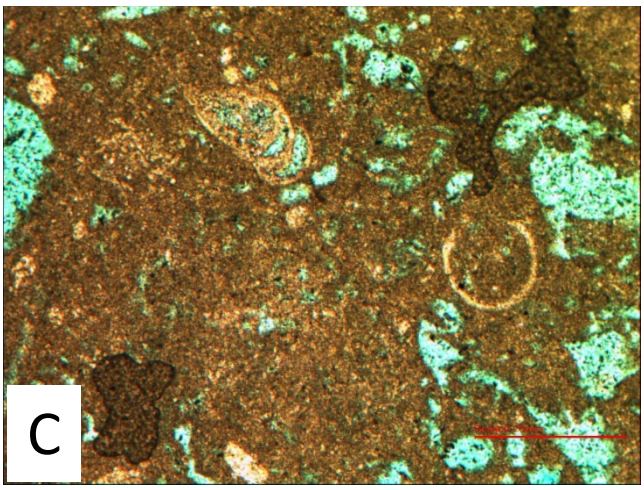
E. Serpulid sp., Well-D, 8608.2', field of view 6.3 mm.

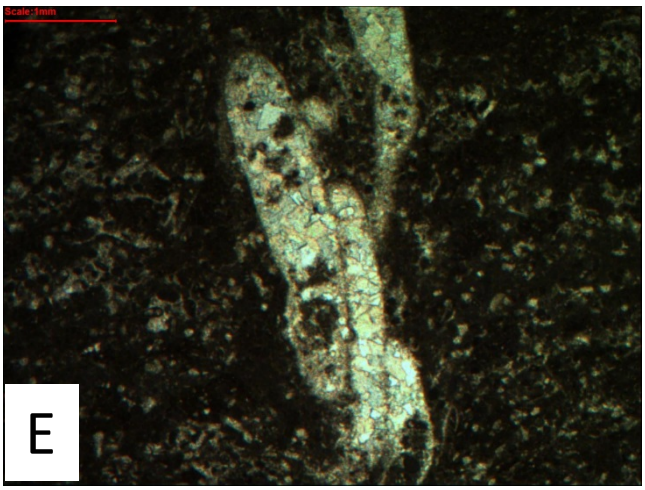
F. *Terebella* sp. cf.*T. lapilloides* Münster (1833), Well-B, 8361.8', field of view 2.5 mm.

Plate 74









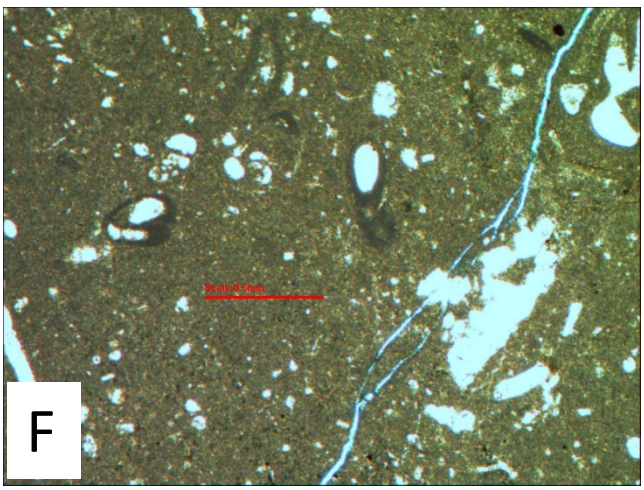


Plate 75

A. Scleractinian coral, Well-B, 8361.8’, field of view 6.3 mm.

B. Gastropoda sp1. (pelagic?), Well-D, 8609.7’, field of view 6.3 mm.

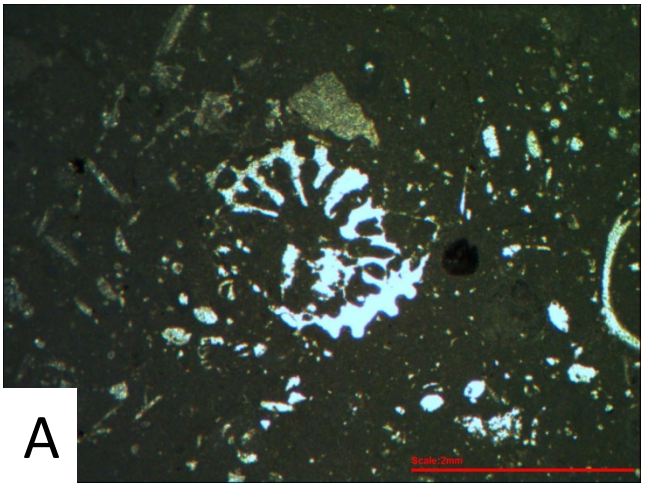
C. Cerithiidae sp., Well-H, 6414.8’, field of view 6.3 mm.

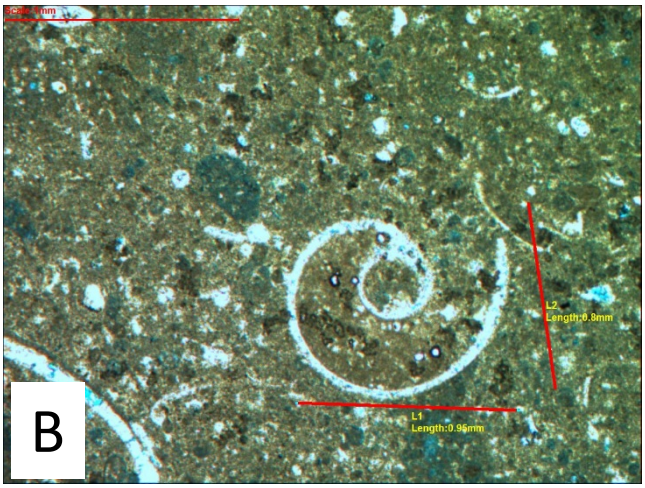
D. Gastropoda sp., Well-D, 7957.2’, field of view 1.25 mm.

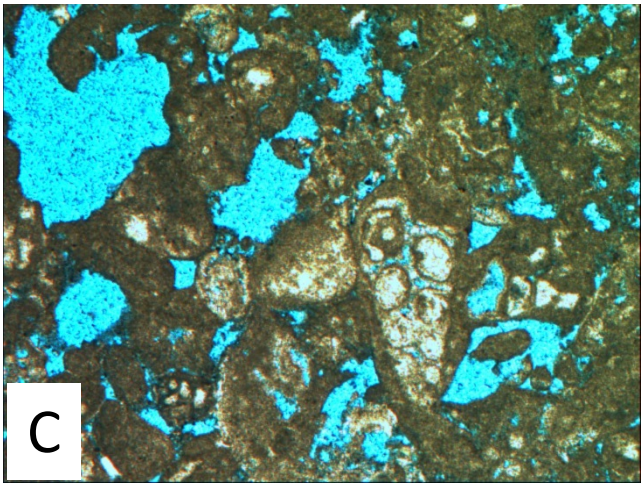
E. Gastropoda sp., Well-F, 8455.5’, field of view 6.3 mm.

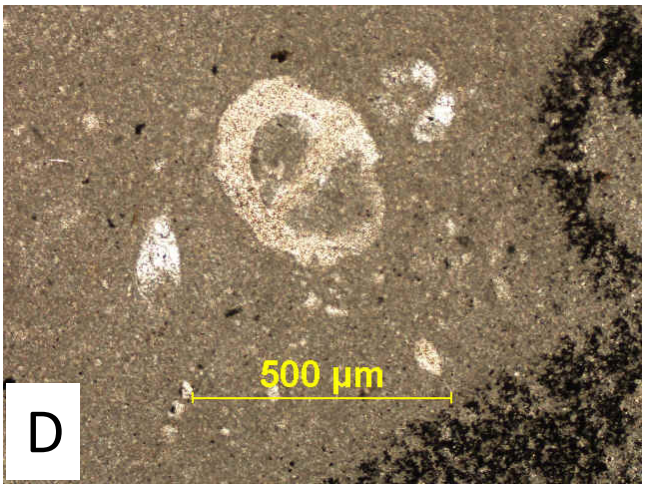
F. Gastropoda sp., Well-I, 5477.7’, field of view 6.3 mm.

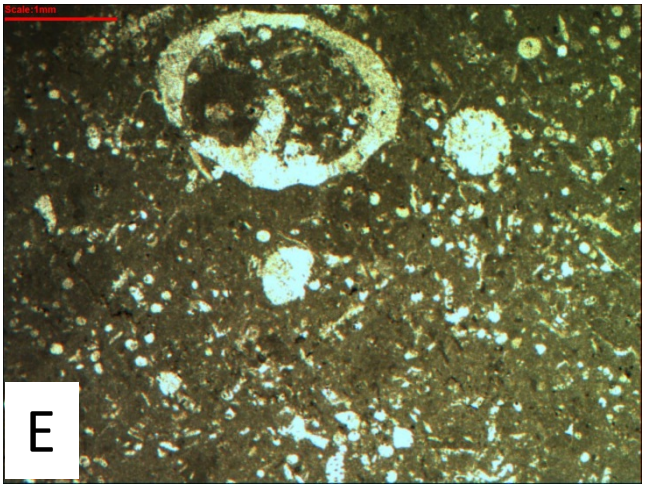
Plate 75


A
Scale:2mm


B
L2
Length:0.8mm
L1
Length:0.96mm


C


D
500 µm


E

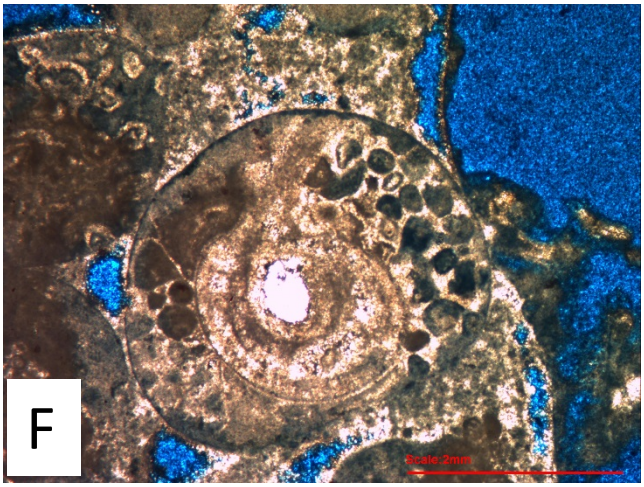

F
Scale:2mm

Plate 76

A. Bivalve fragment, crushed bivalve mosaic spar cement Well-A, 4058.7', field of view 6.3 mm.

B. Bivalve fragment, Well-G, 6775.6', field of view 6.3 mm.

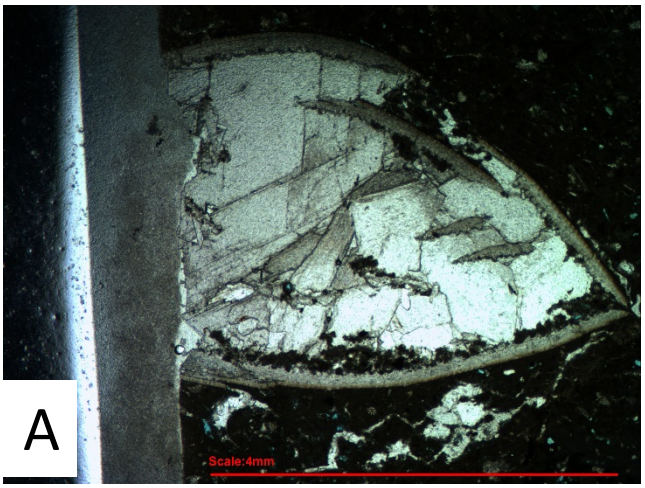
C. Bivalve fragment, Well-D, 8641.2', field of view 2.5 mm.

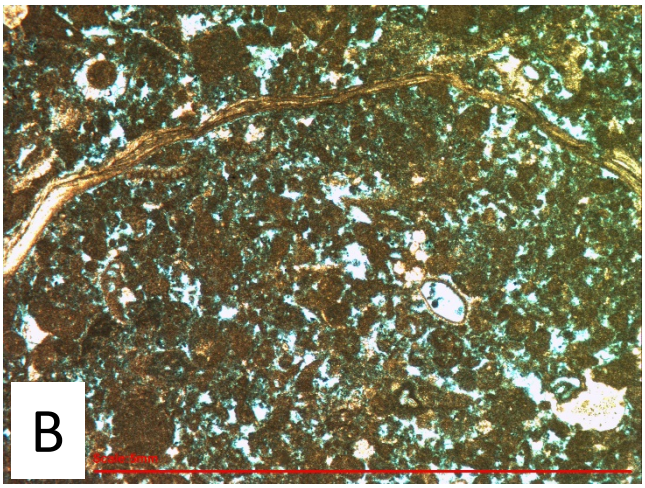
D. Costate bivalve sp., Well-B, 8357', field of view 6.3 mm.

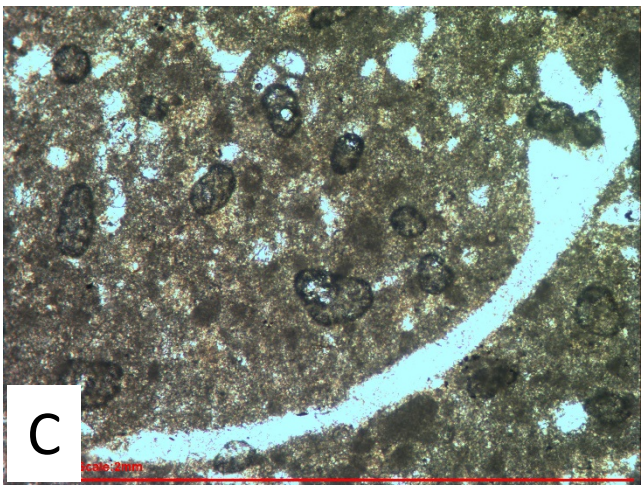
E. *Inoceramus* sp. (fragment), thick prismatic calcite piece, Well-D, 7960.2', field of view 6.3 mm.

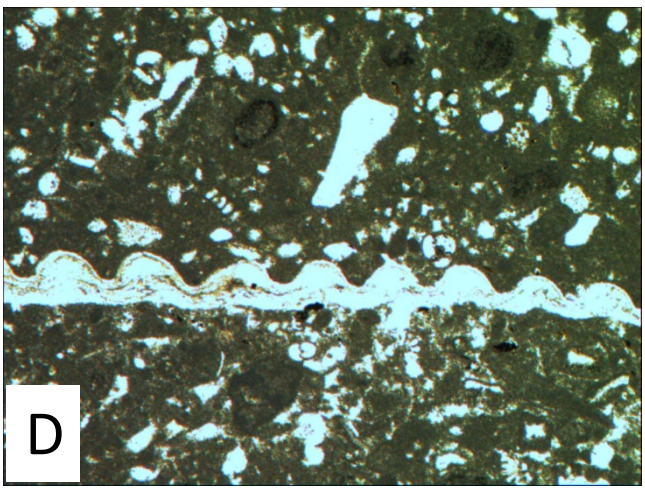
F. Costate bivalve sp., Well-D, 7960.2', field of view 6.3 mm.

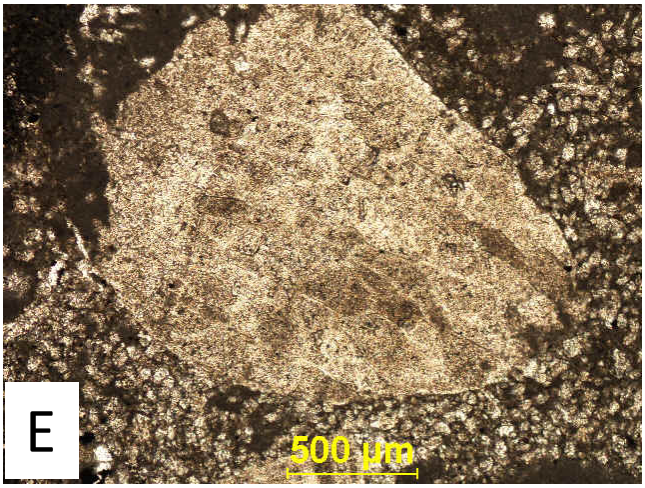
Plate 76











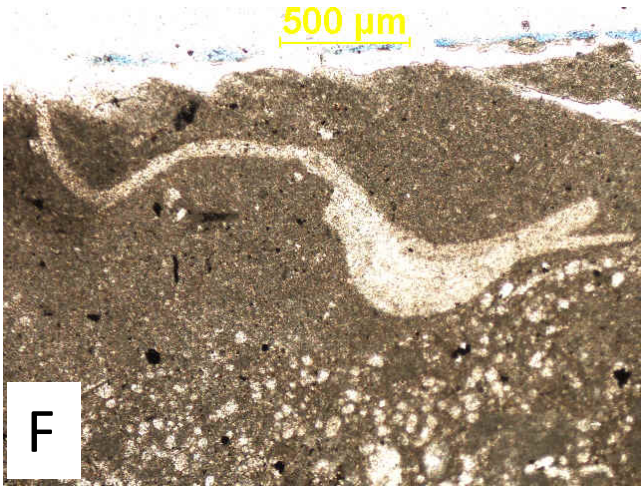


Plate 77

A. Oyster, Well-G, 6761.3’, field of view 6.3 mm.

B. Oyster, affected by *Lithocodium* borings and microbial activity, Well-G, 6761.3’, field of view 6.3 mm.

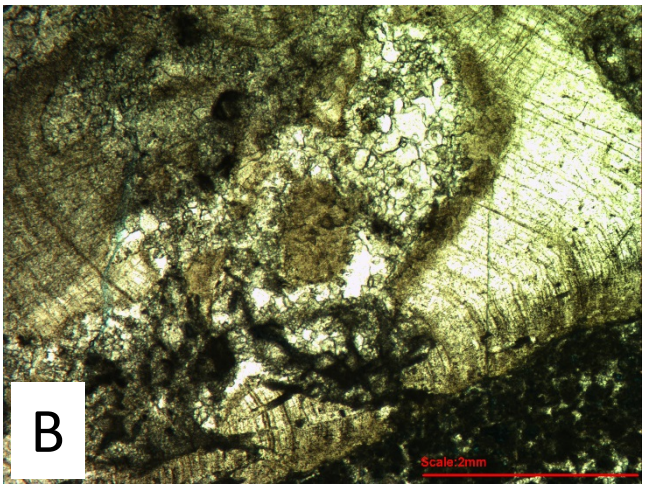
C. Oyster, affected by *Lithocodium* borings and microbial activity, Well-G, 6761.3’, field of view 6.3 mm.

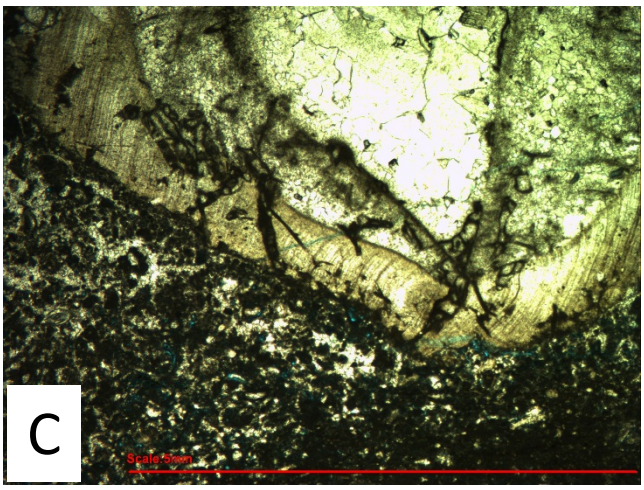
D. Possible asteroid species within pellet packstone of protected internal shoal, Well-F, 8425.5’, field of view 6.3 mm.

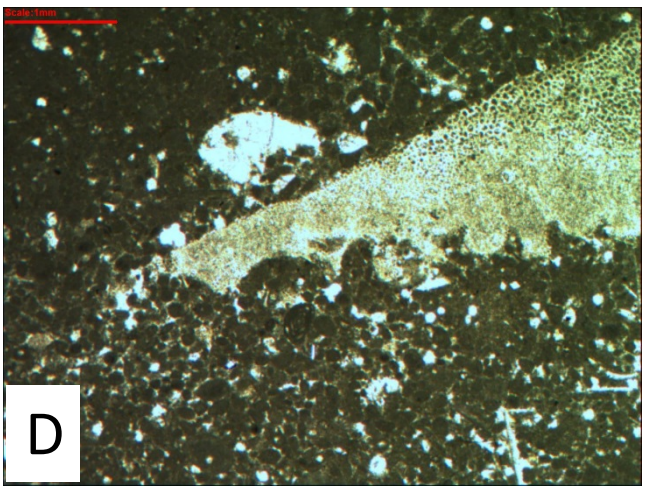
E. Echinoid plate, Well-D, 7957.2’, field of view 2.5 mm.

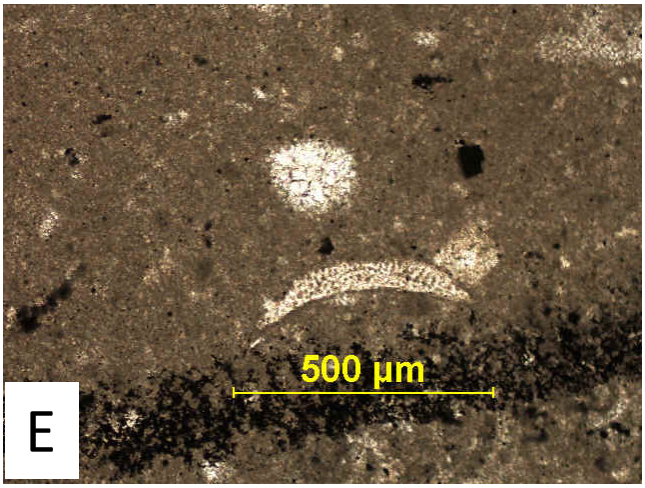
F. Echinoid plate with syntaxial overgrowth cement, Well-H, 6422.5’, field of view 2.5 mm.

Plate 77









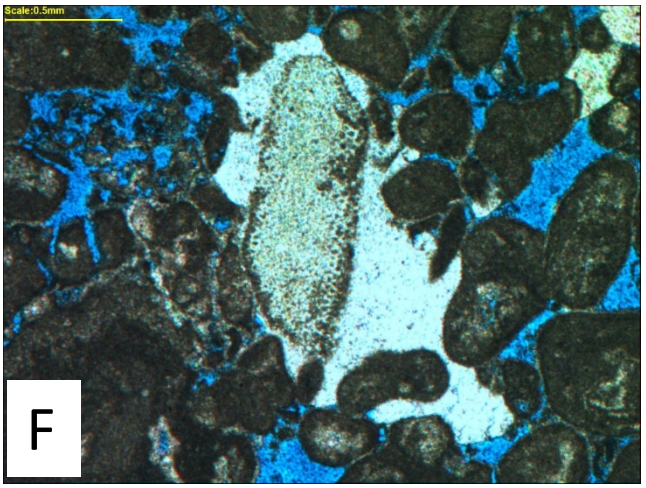


Plate 78

A. Echinoid plate with syntaxial overgrowth cement, Well-I, 5533.2', field of view 6.3 mm.

B. Echinoid plates with syntaxial overgrowth cement, Well-I, 5543.2', field of view 6.3 mm.

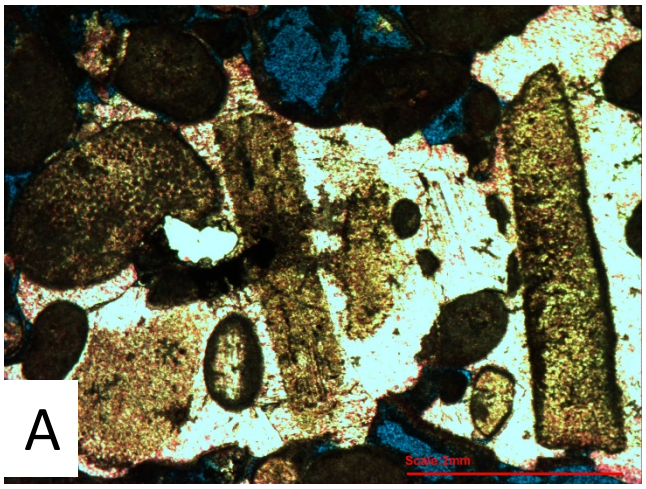
C. Echinoid plate with syntaxial overgrowth cement, Well-I , 5533.2', field of view 2.5 mm.

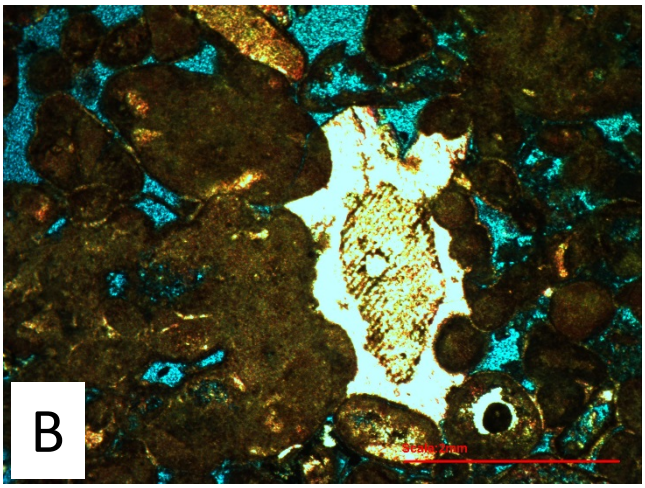
D. Echinoid plates with syntaxial overgrowth cement, Well-I, 5542.2', field of view 6.3 mm.

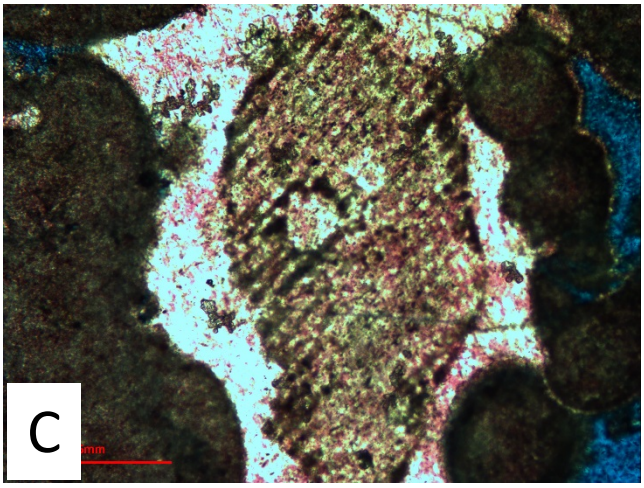
E. Crinoid plate with syntaxial overgrowth cement, Well-H, 6414.8', field of view 2.5 mm.

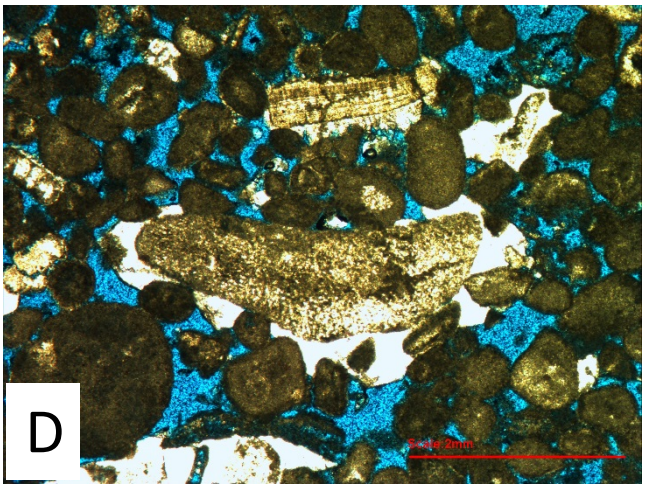
F. Crinoid plate with syntaxial overgrowth cement, Well-D, 8521.2', field of view 6.3 mm.

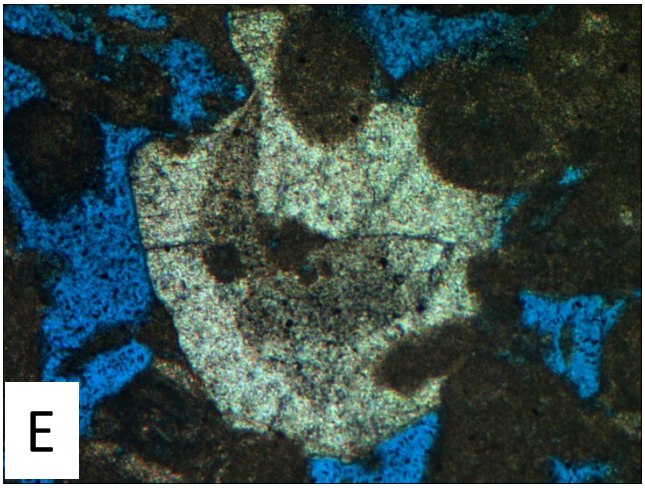
Plate 78











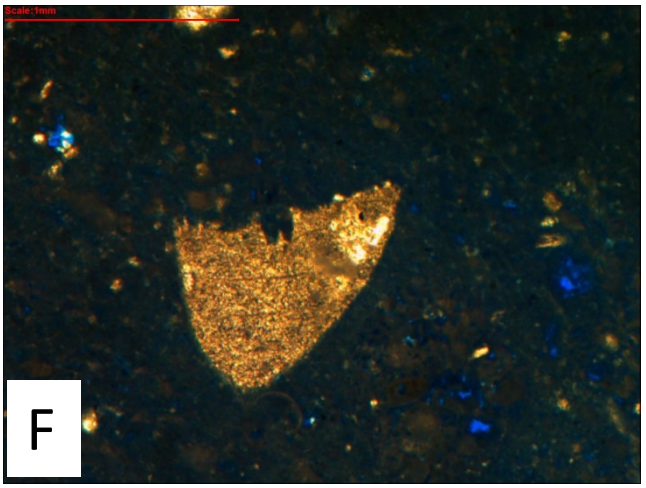


Plate 79

A. Spine of regular echinoid with syntaxial overgrowth cement, Well-D, 8521.2', field of view 2.5 mm.

B. Spine of regular echinoid, Well-I, 5536.2', field of view 2.5 mm.

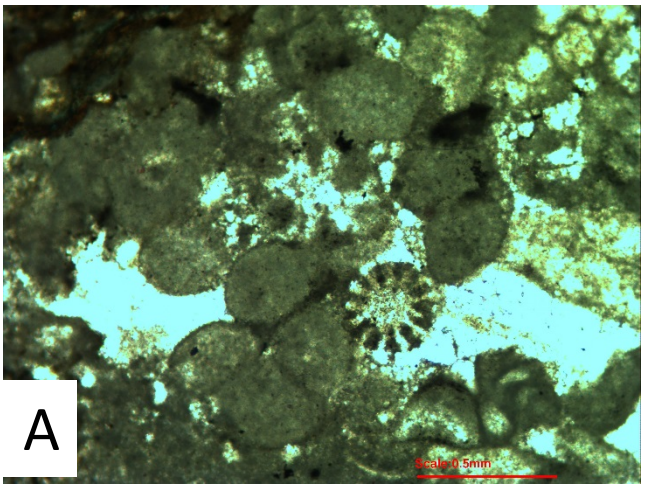
C. Spine of regular echinoid, Well-I, 5543.2', field of view 1.25 mm.

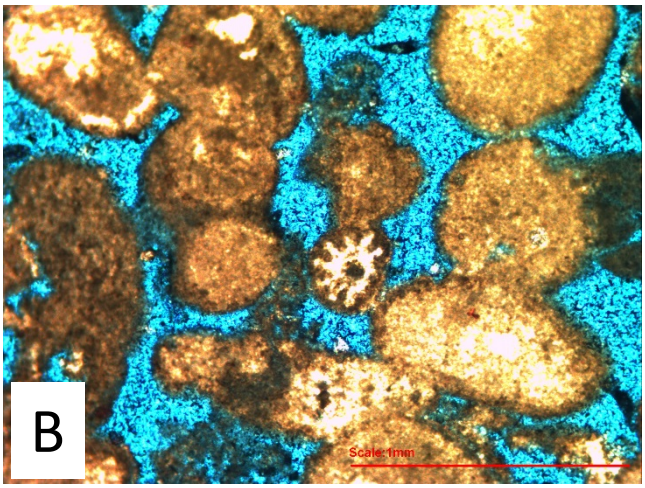
D. Oblique section through a spine of a regular echinoid in pelagic mudstone, Well-I, 5542.2', field of view 6.3mm.

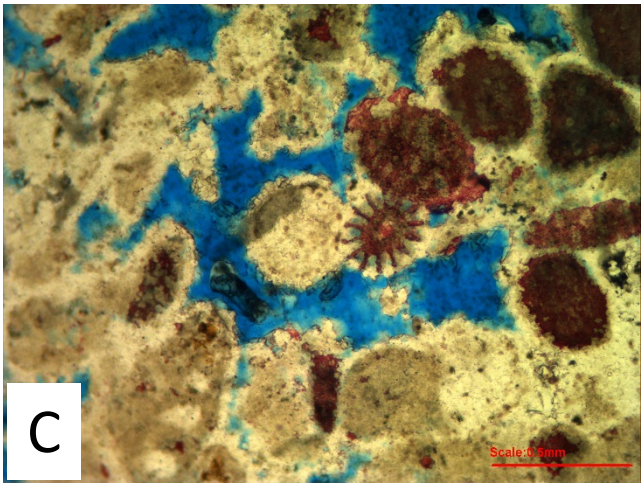
E. *Saccocoma* sp., Well-A, 4061.6', field of view 2.5 mm.

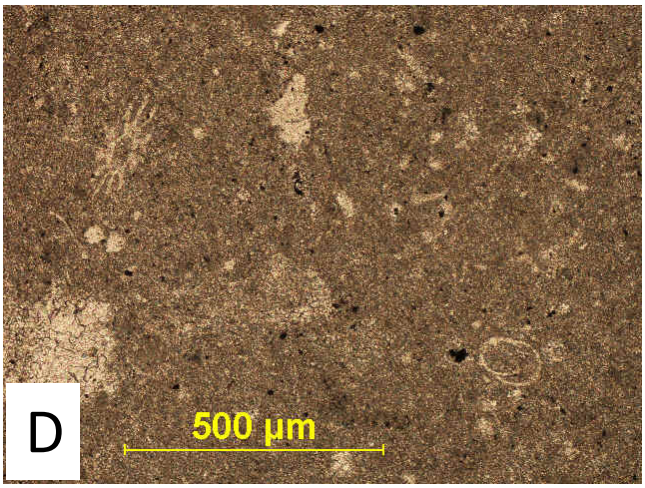
F. *Saccocoma* sp., in cross-polarized light XPL, Well-A, 4061.6', field of view 2.5 mm.

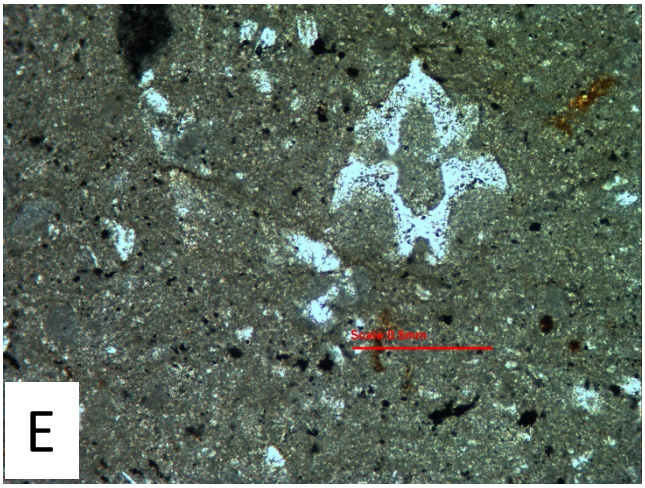
Plate 79











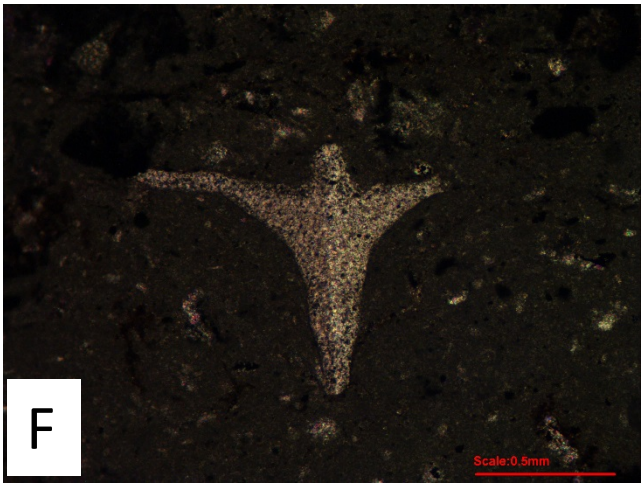


Plate 80

A. Section through an ostracod valve, Well-A, 4058.7’, field of view 2.5 mm.

B. Section through the carapace if an ostracod valve, Well-D, 8638.2’, field of view 2.5 mm.

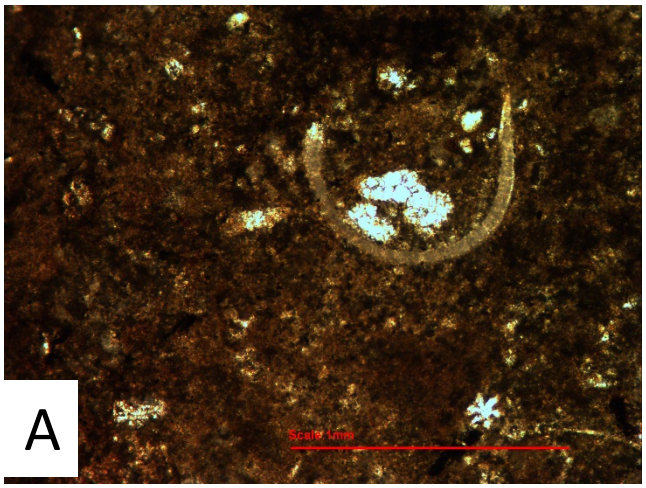
C. Section through an ostracod valve, Well-D, 8644.2’, field of view 0.61 mm.

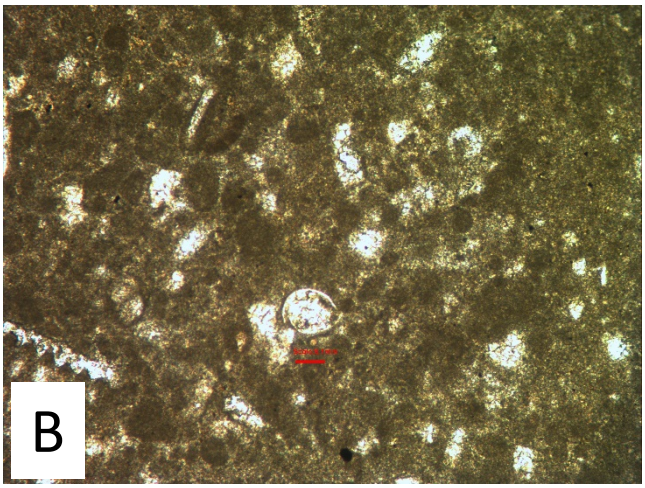
D. Section through the carapace if an ostracod valve, Well-I, 5448.7’, field of view 2.5 mm.

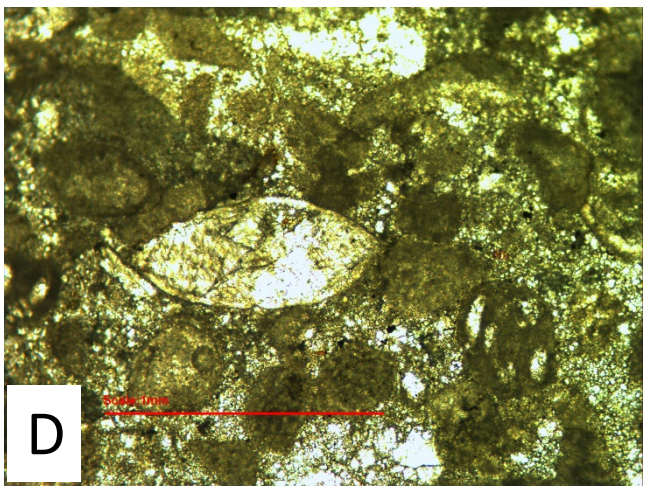
E. Section through the carapace if an ostracod valve, Well-I, 5448.7’, field of view 2.5 mm.

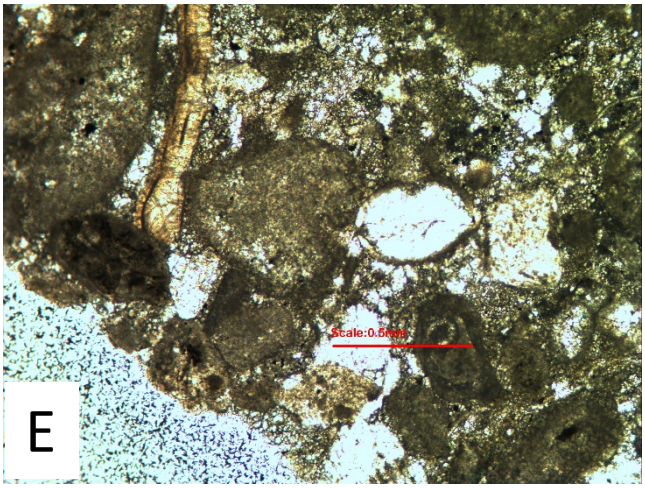
F. *Favreina* sp. cf. *F. dinarica* Brönnimann (1976), Well-B, 8421.6’, field of view 2.5 mm.

Plate 80









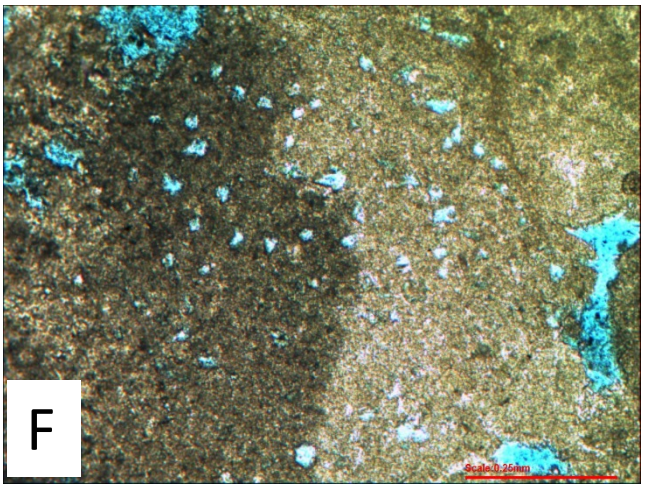


Plate 81

A. *Favreina* sp. cf. *F. dinarica* Brönnimann (1976), Well-G, 6779.5', field of view 6.3 mm.

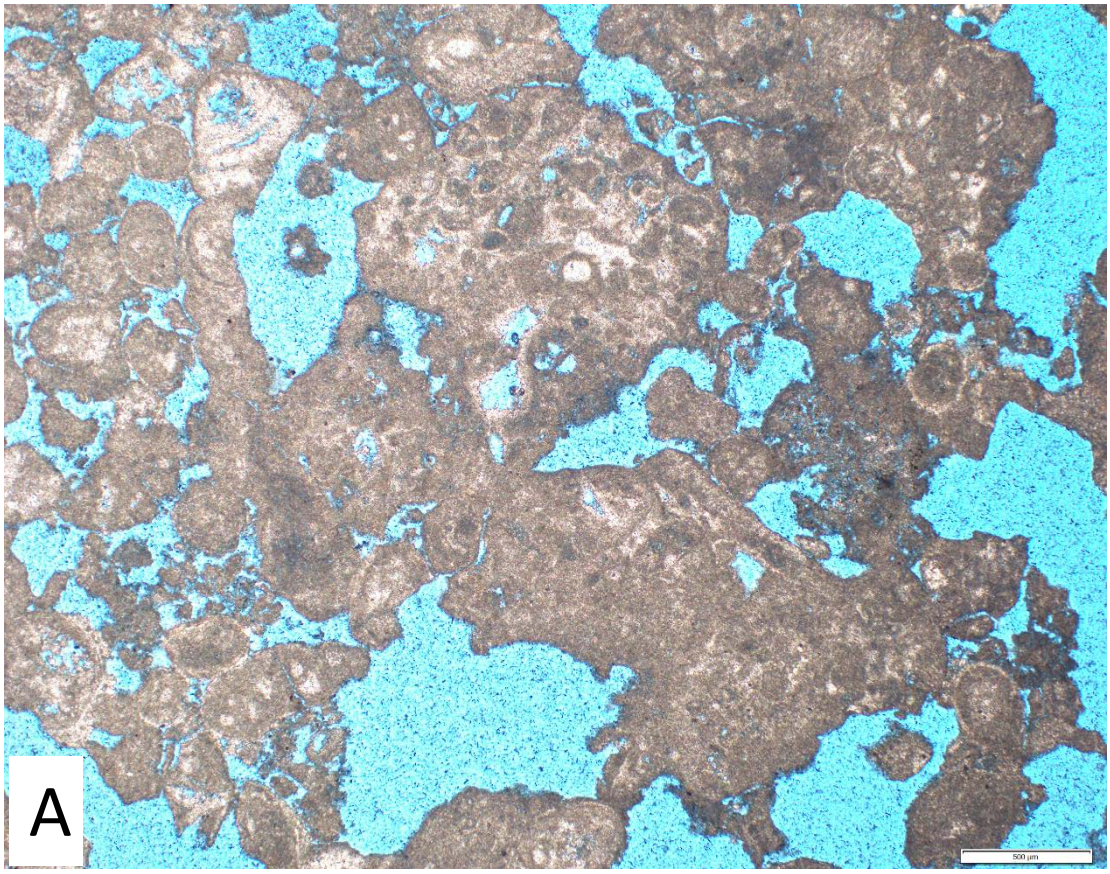
Plate 81

Plate 82

A. HMF 1: Porous, Intraclastic, Foraminferal and Peloidal Packstone, Well-H, 6427.5‘, This microfacies is highly porous (~20%) and has potential reservoir quality with fenestral (FE), interparticle (BP) and intraparticle (IP) porosities.

B. HMF 1: Porous, Intraclastic, Foraminferal and Peloidal Packstone, Well-H, 6427.5‘.

Plate 82



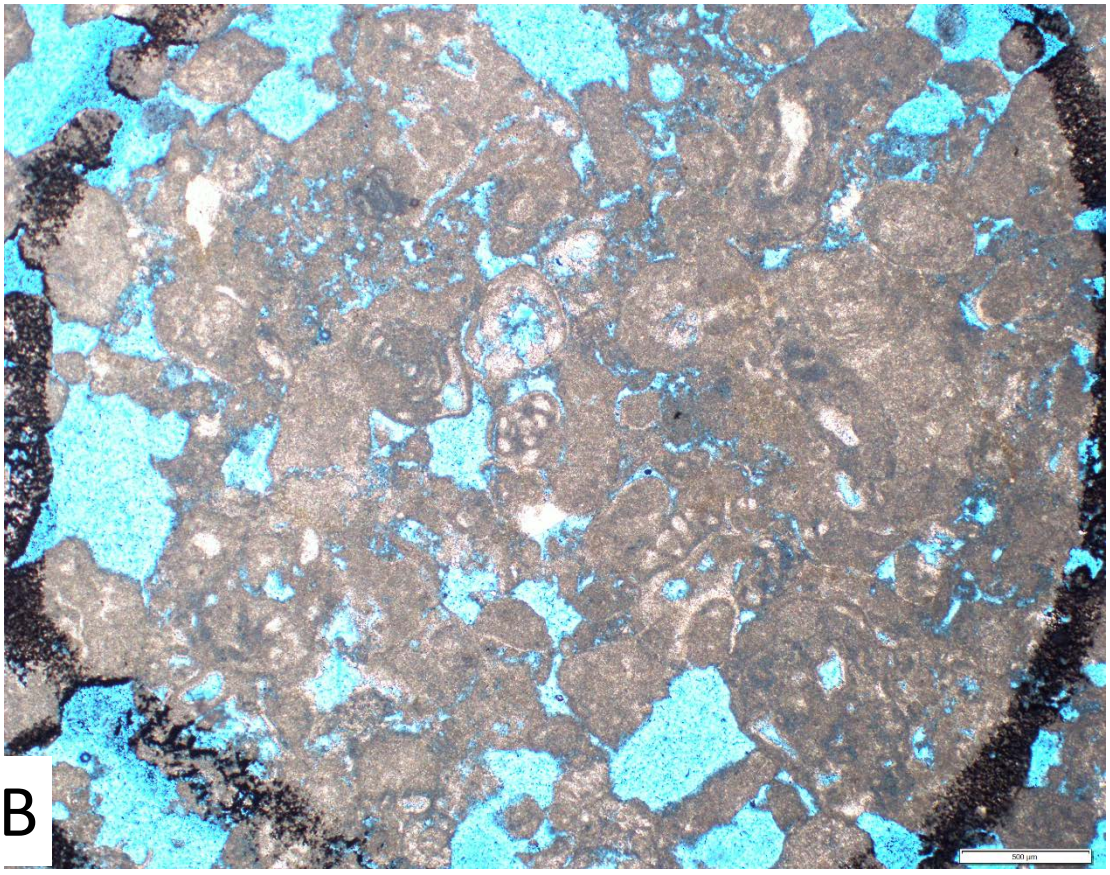


Plate 83

A. HMF 2: Finely Laminated Mudstone, Well-H, 6426.5‘. Microfacies porosity is from 0 % to <0.5 % of a moldic (MO) porosity type. Almost all of the porosity is formed by the empty spaces left by dissolved grains.

A. HMF 2: Finely Laminated Mudstone, Well-H, 6415.7‘. This microfacies is characterised by being barren of microfossils to one of very low biodiversity. It only contains occasional, thin-walled ostracods.

Plate 83

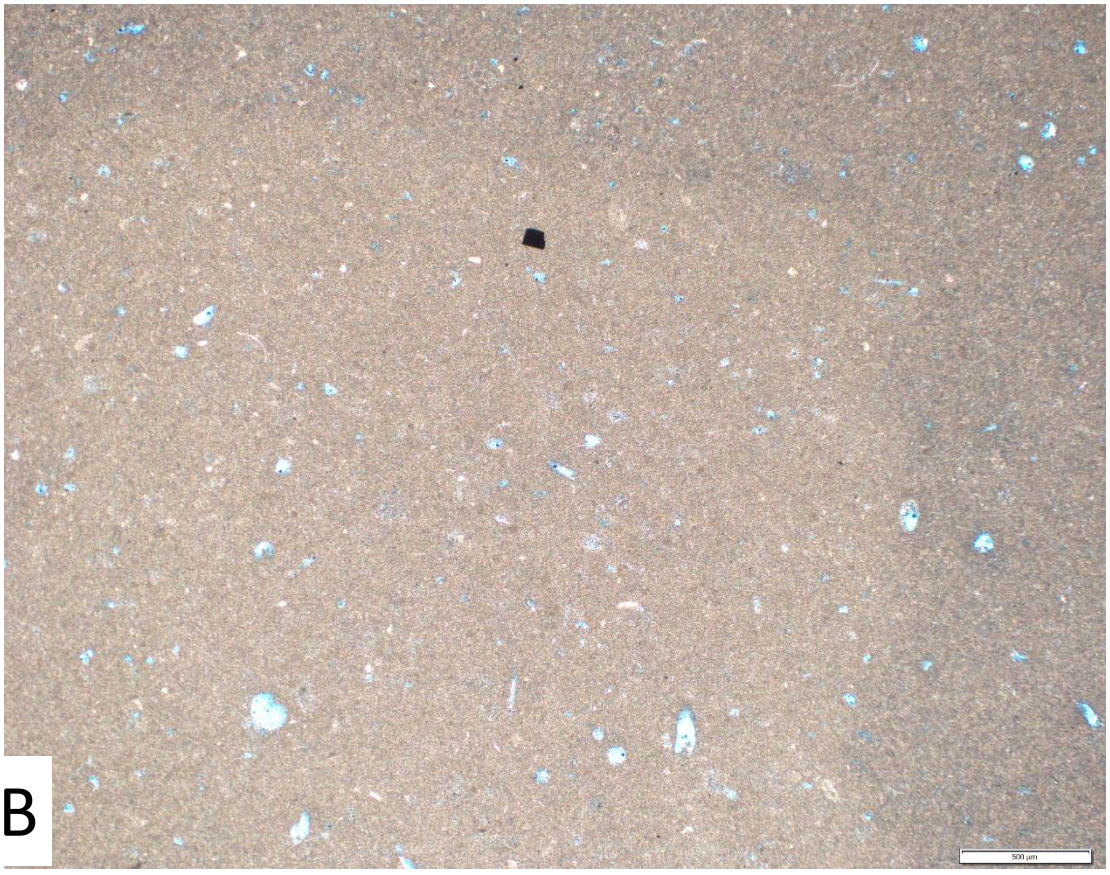
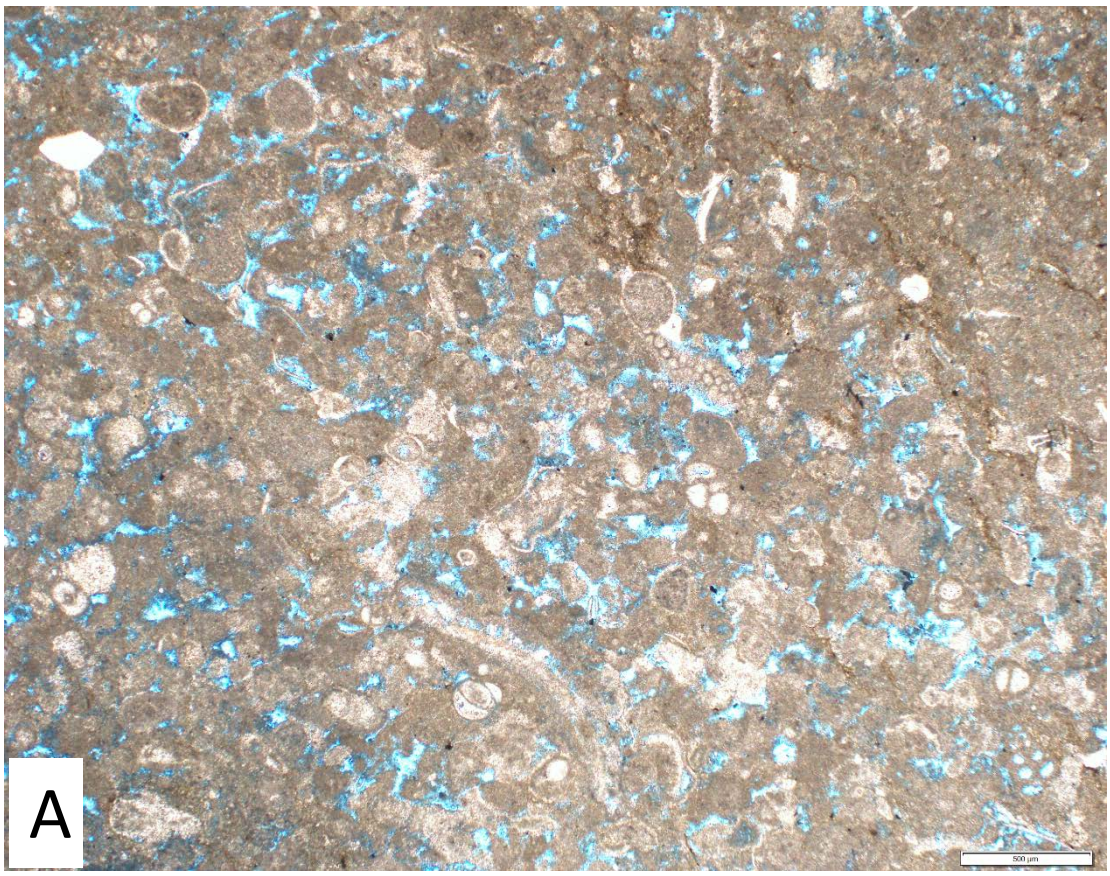


Plate 84

A. HMF 3: Peloidal, Foraminiferal and Intraclastic Packstone , Well-H, 6409.2‘. This microfacies contains diagnostic microfossils indicating a lagoonal to protected open marine environment. This includes *Quinqueloculina* spp., miliolids, *Istriloculina* spp., *Gaudryinopsis* sp., and *Verneuilinoides polonicus*. Blue colour is void and representing (5–20%) interparticle (BP) and intraparticle (IP) porosities.

B. HMF 3: Peloidal, Foraminiferal and Intraclastic Packstone , Well-H, 6425.5’ (x2). Blue colour is void and representing (5–20%) interparticle (BP) and intraparticle (IP) porosities.

Plate 84



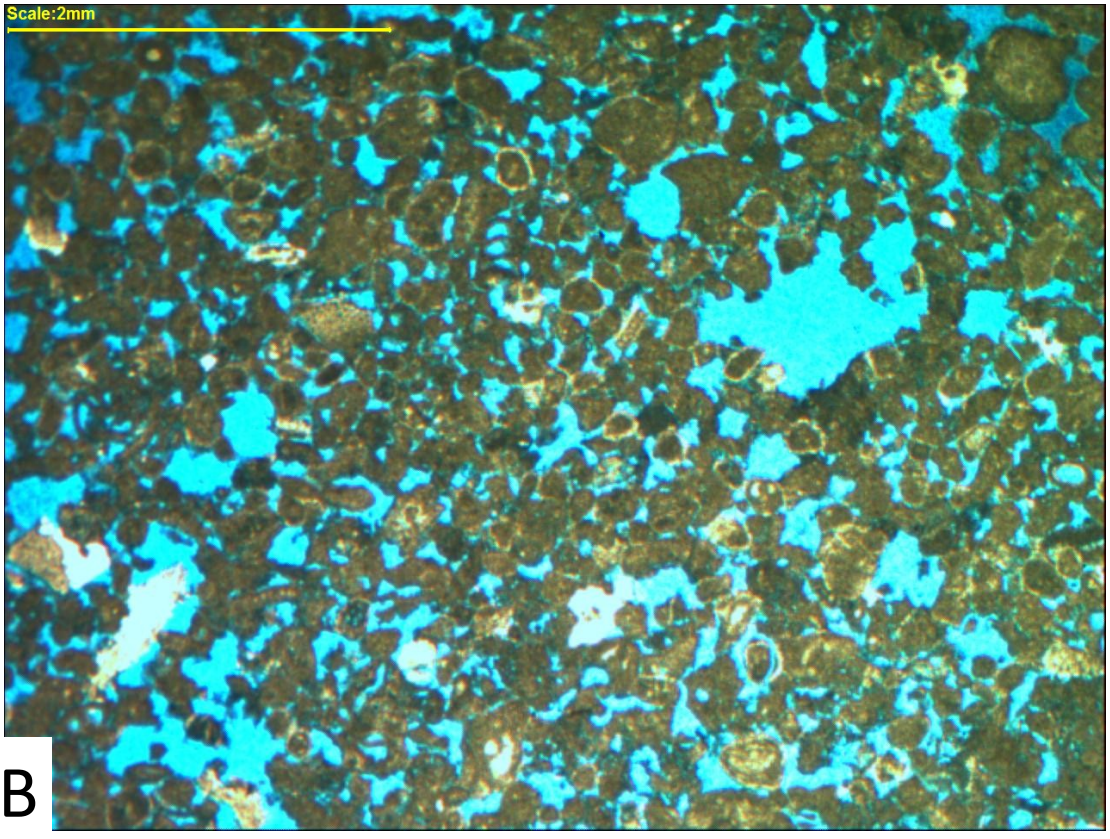
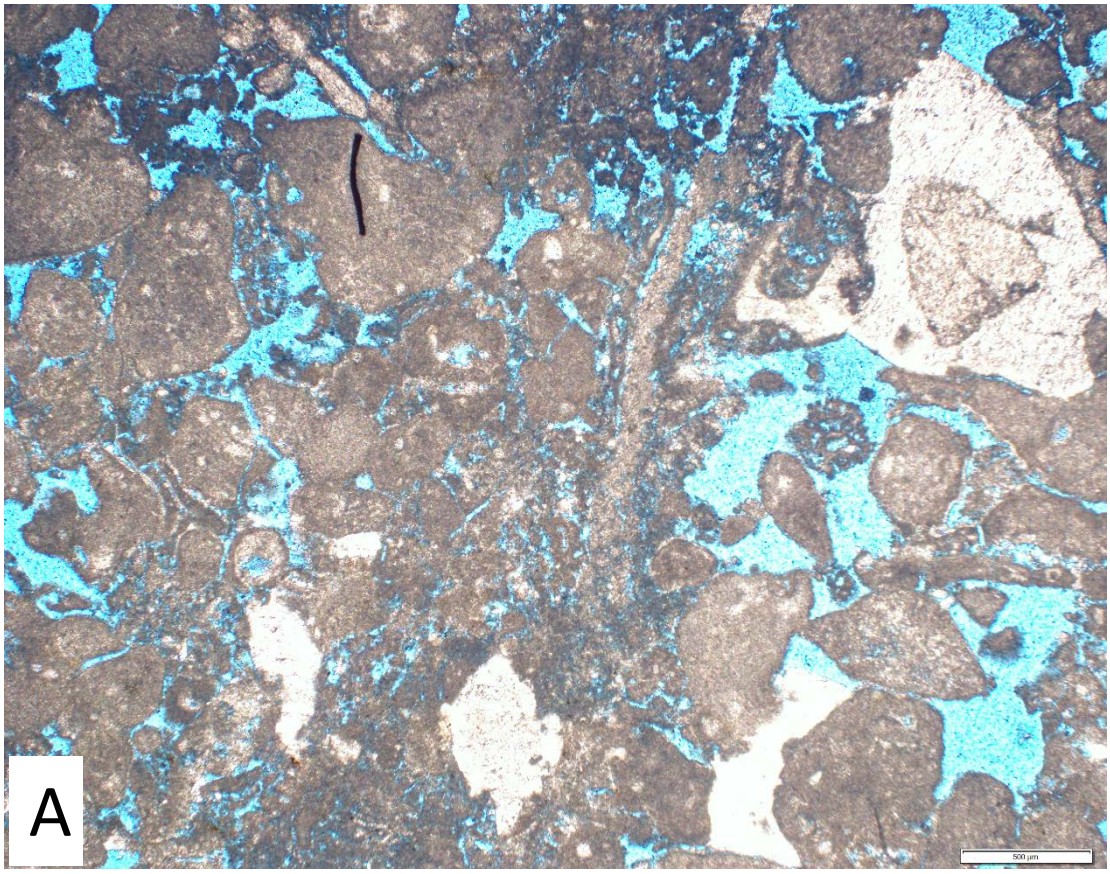


Plate 85

A. HMF 3: Peloidal, Foraminiferal and Intraclastic Packstone , Well-H, 6391.1‘. This microfacies is characterized by fine grained packstone and grainstone made of peloids, coated grains, lithoclastics and benthic foraminifera.

B. HMF 3: Peloidal, Foraminiferal and Intraclastic Packstone , Well-H, 6416.5’. The vadose zone micro-stalactite dripstone cement or pendant type of cement.

Plate 85



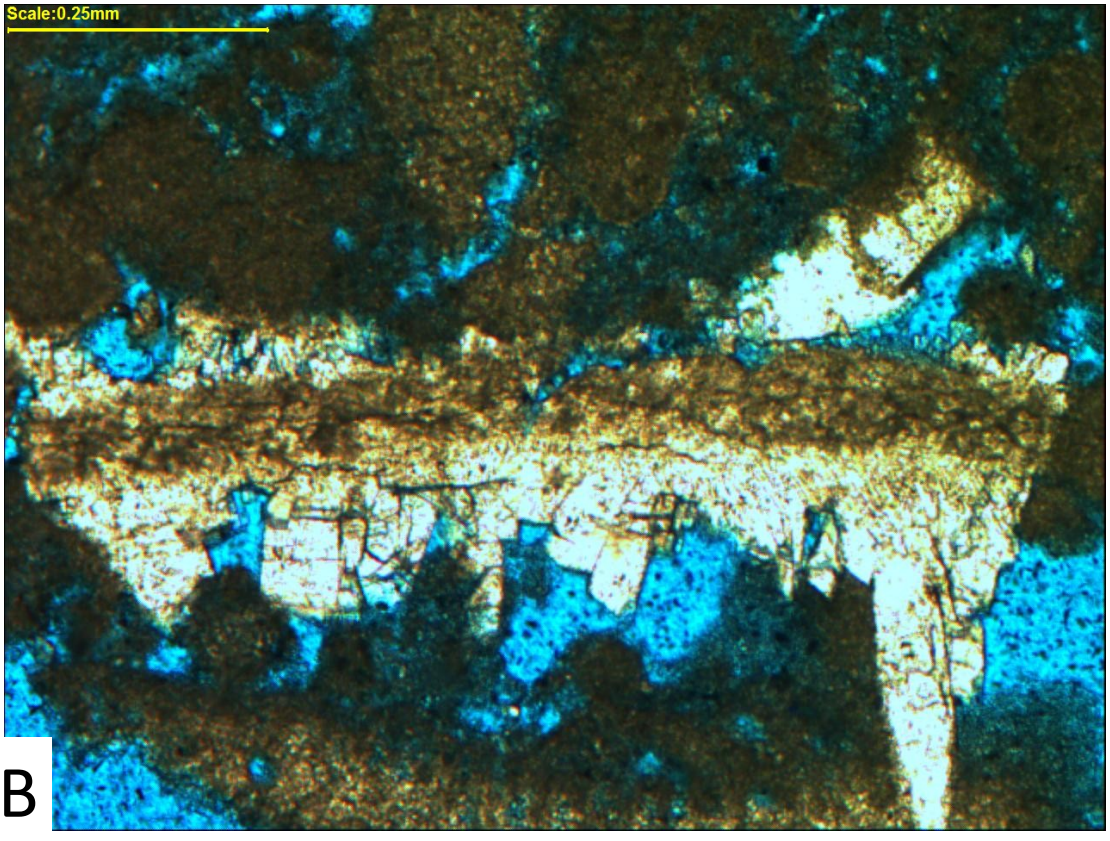
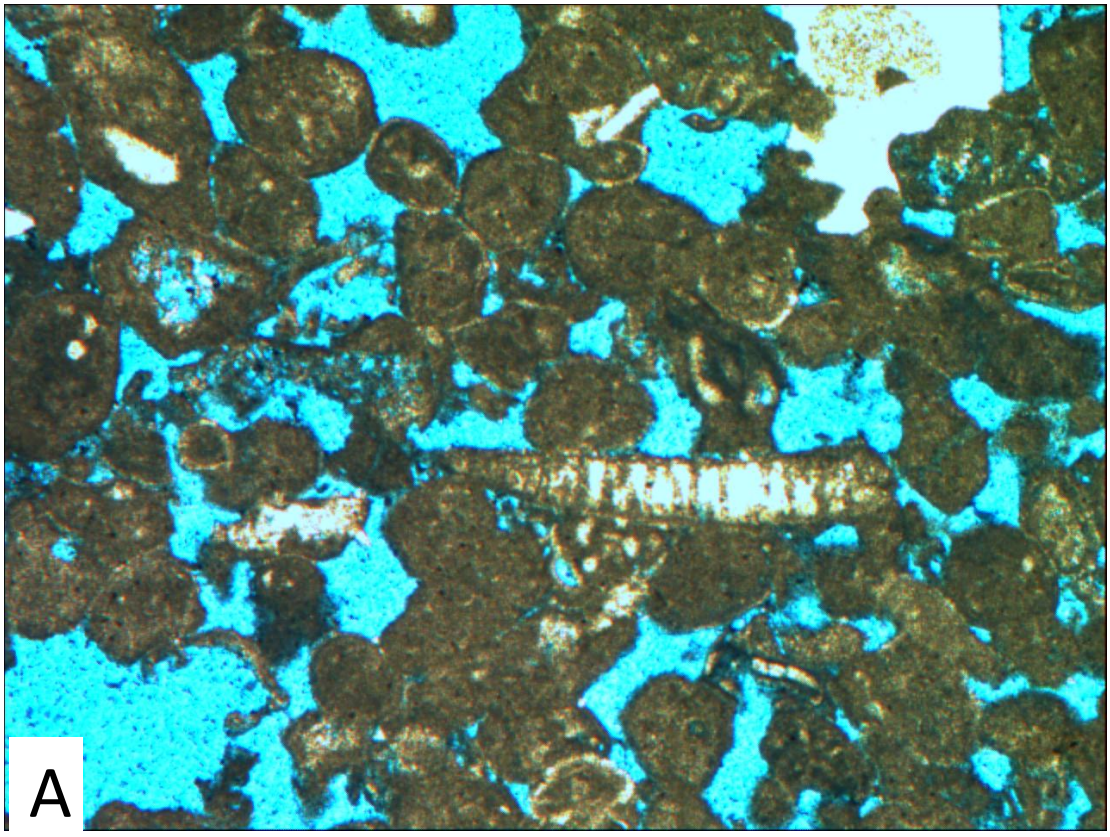


Plate 86

A. HMF 3: Peloidal, Foraminiferal and Intraclastic Packstone , Well-H, 6414.8. bivalve enveloped by microbial micrite.

B. HMF 3: Peloidal, Foraminiferal and Intraclastic Packstone , Well-H, 6401.3‘. This microfacies is common with moldic and cavern porosities. This includes *Quinqueloculina* spp., miliolids, Istriloculina spp., *Gaudryinopsis* sp., and *Verneuilinoides polonicus*.

Plate 86



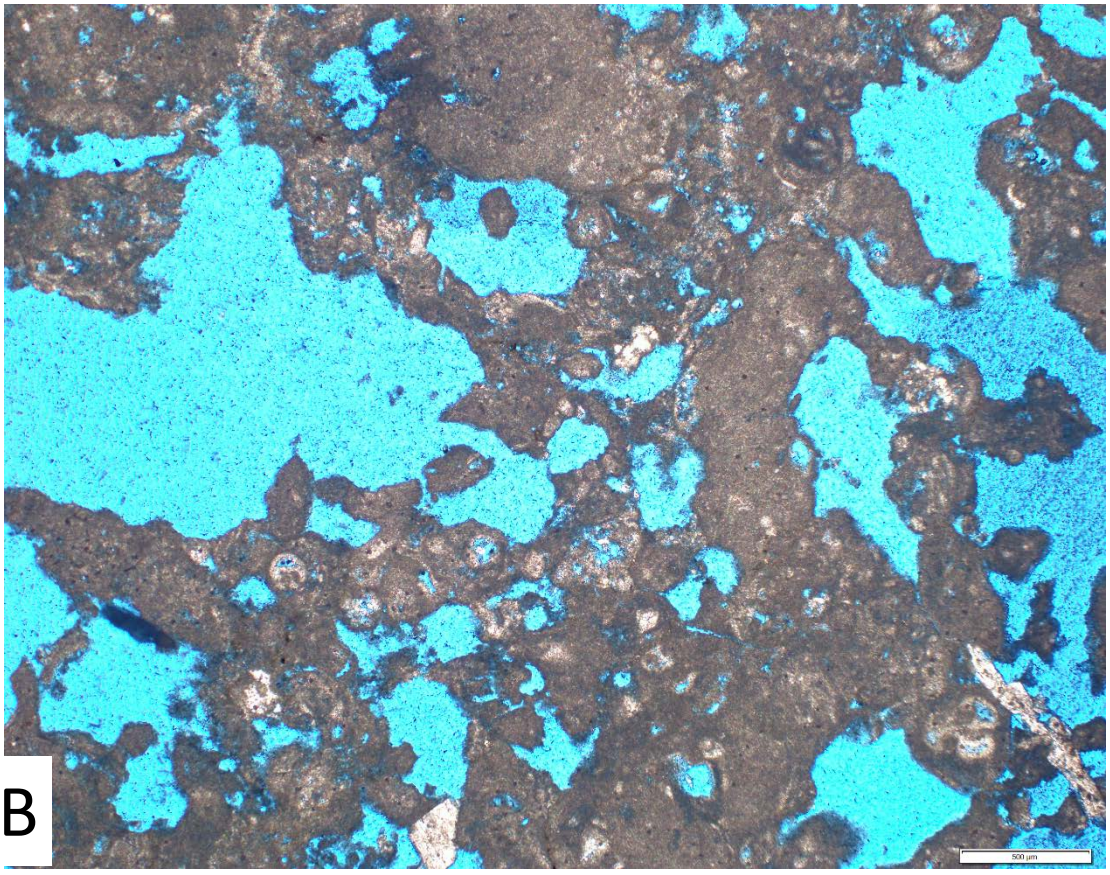
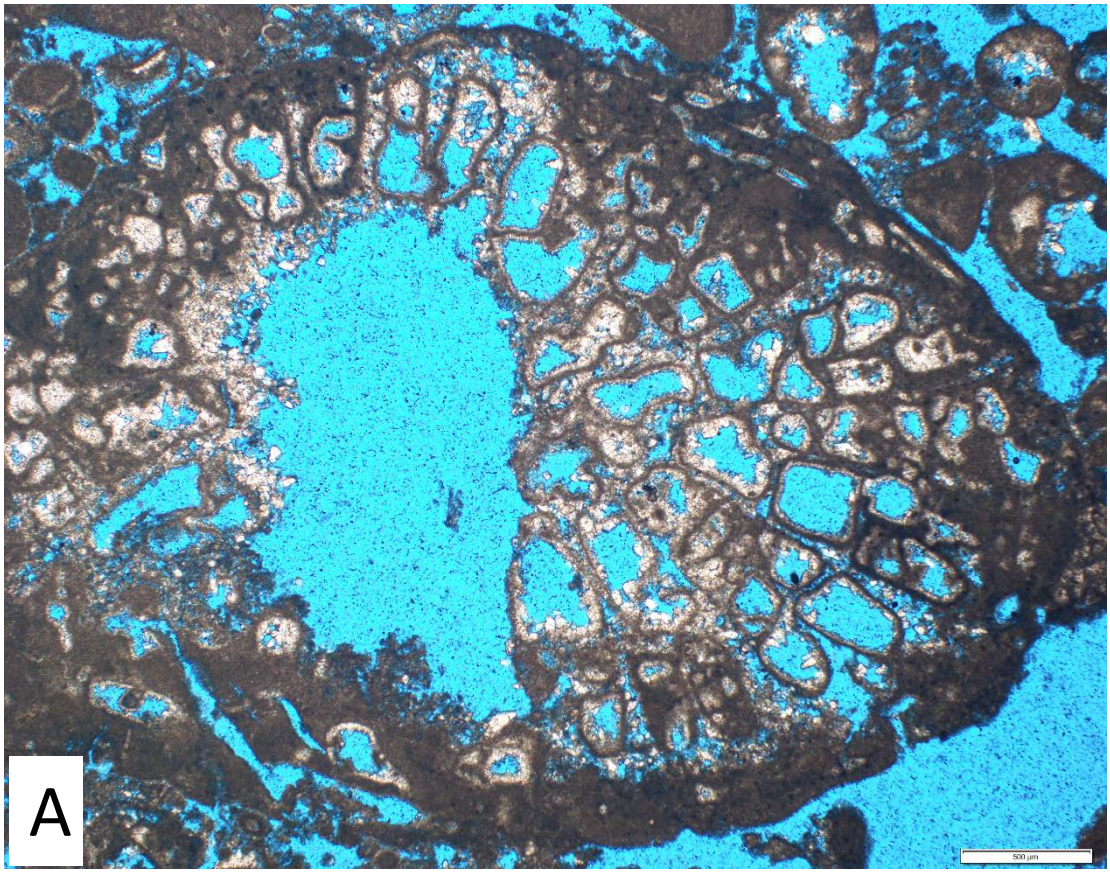


Plate 87

A. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6420.6‘. Large oncoid of *Lithocodium aggregatum* sorrounding a coral.

B. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6420.6‘. This microfacies has potential reservoir quality with intermediate to highly porous moldic (Mo), interparticle (IP) and intraparticle (BP) porosities, with a range of porosity from 5% to 20%.

Plate 87



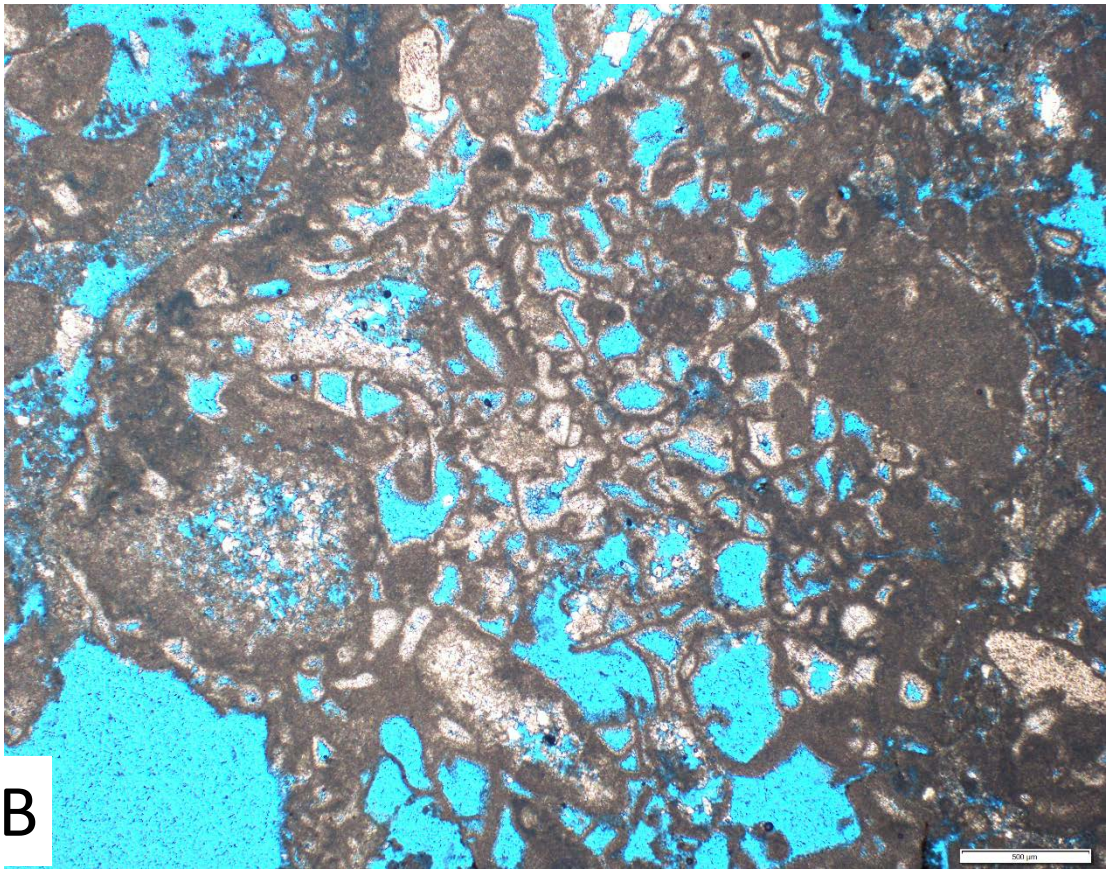
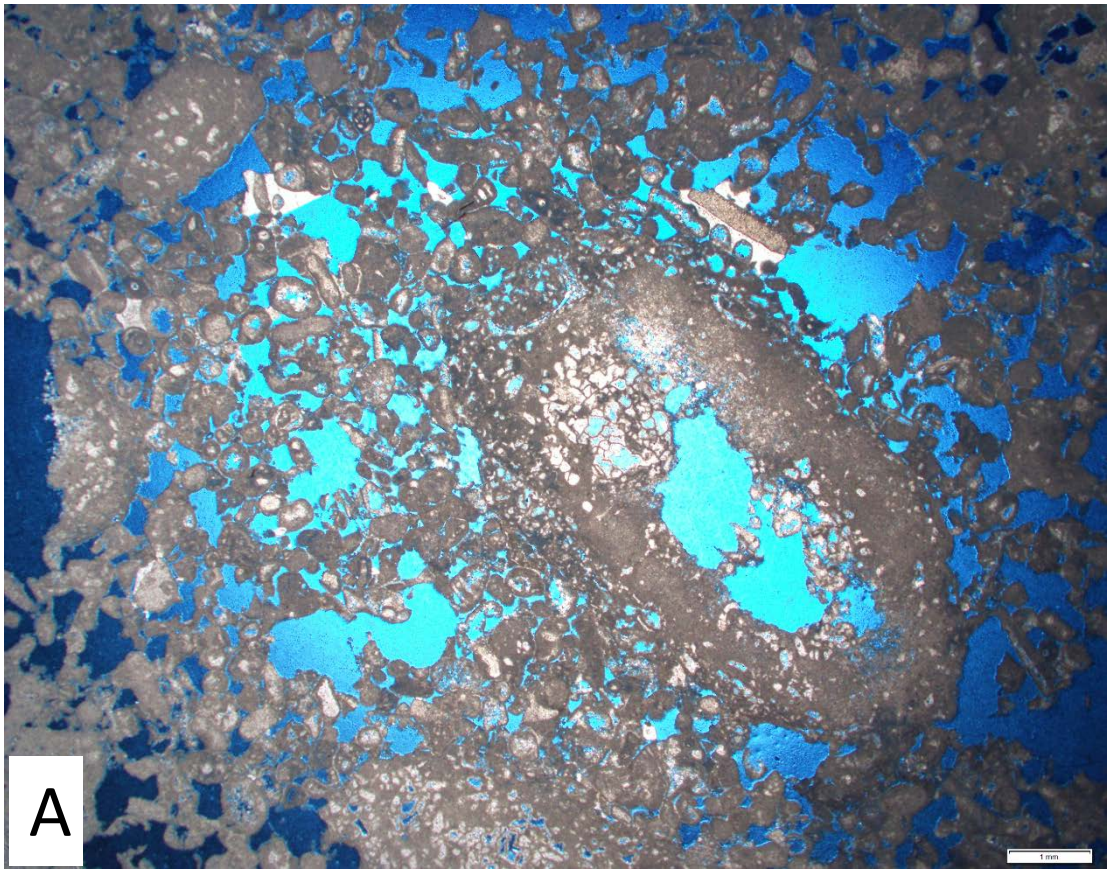


Plate 88

A. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6418.5‘.

B. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6418.5‘.

Plate 88



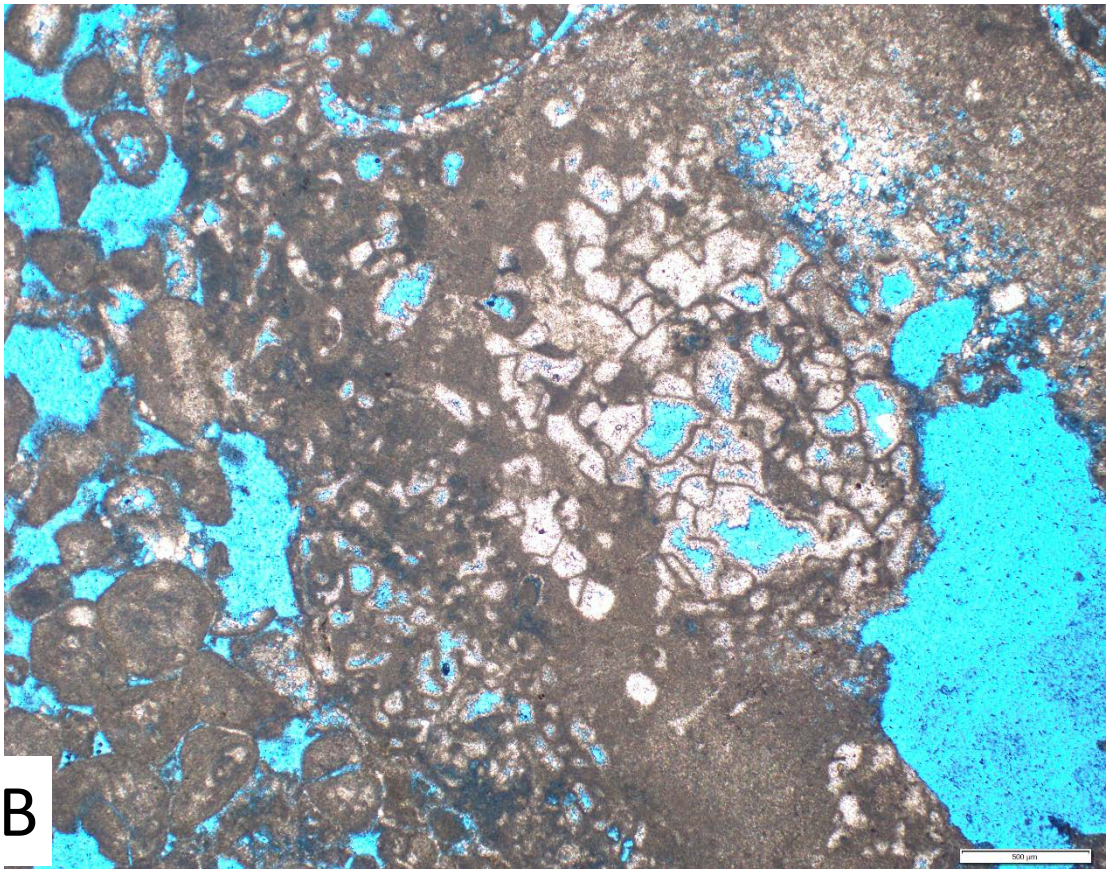
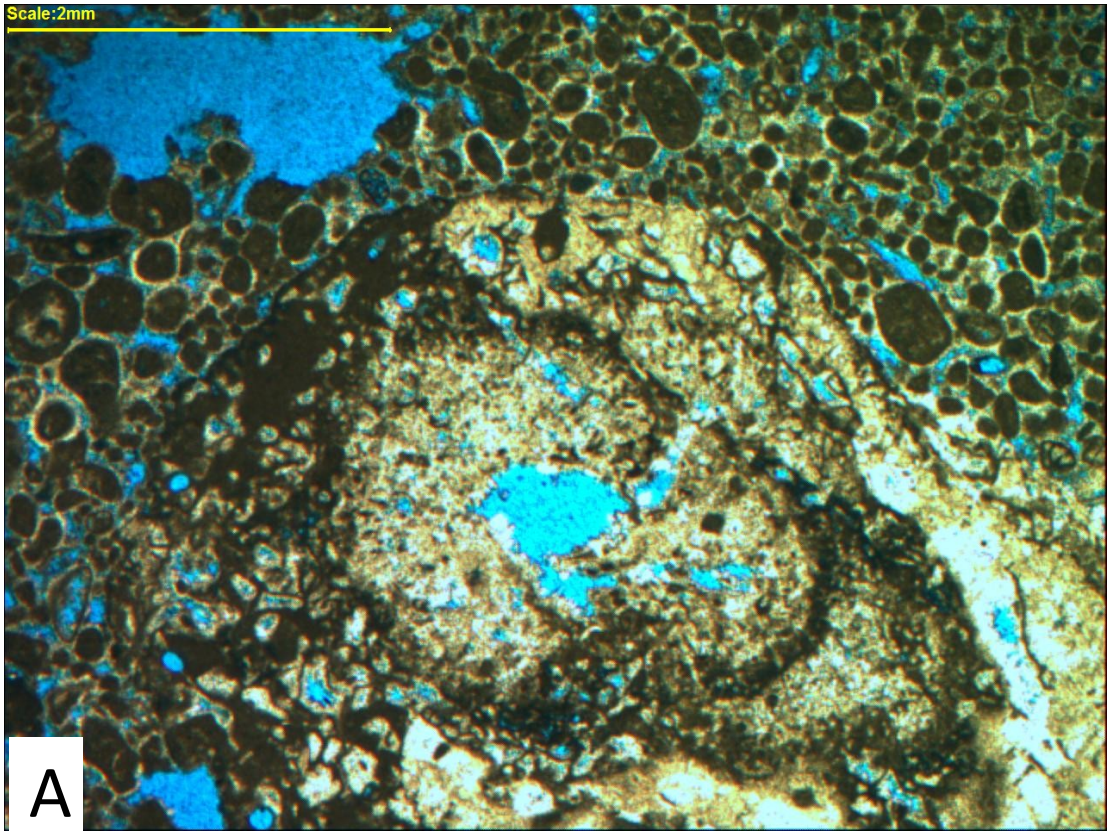


Plate 89

A. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6423.5.

B. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6418.5'.

Plate 89



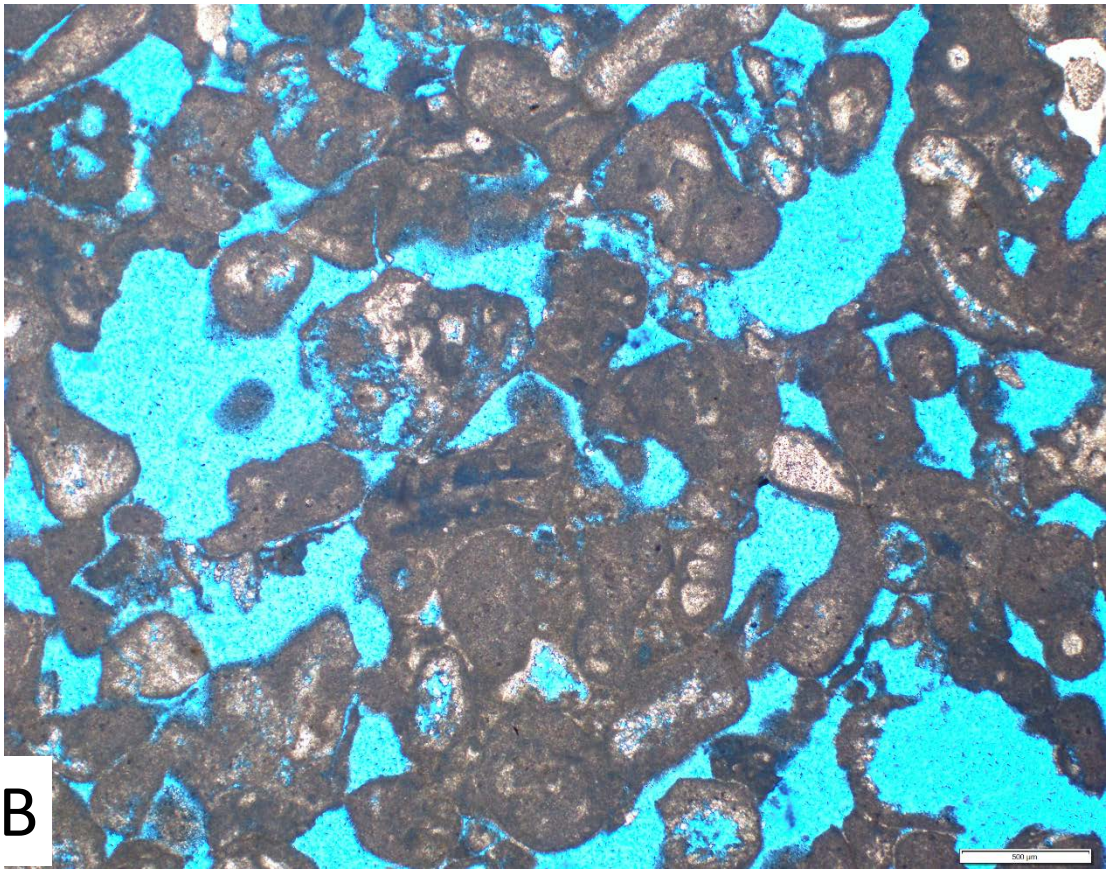
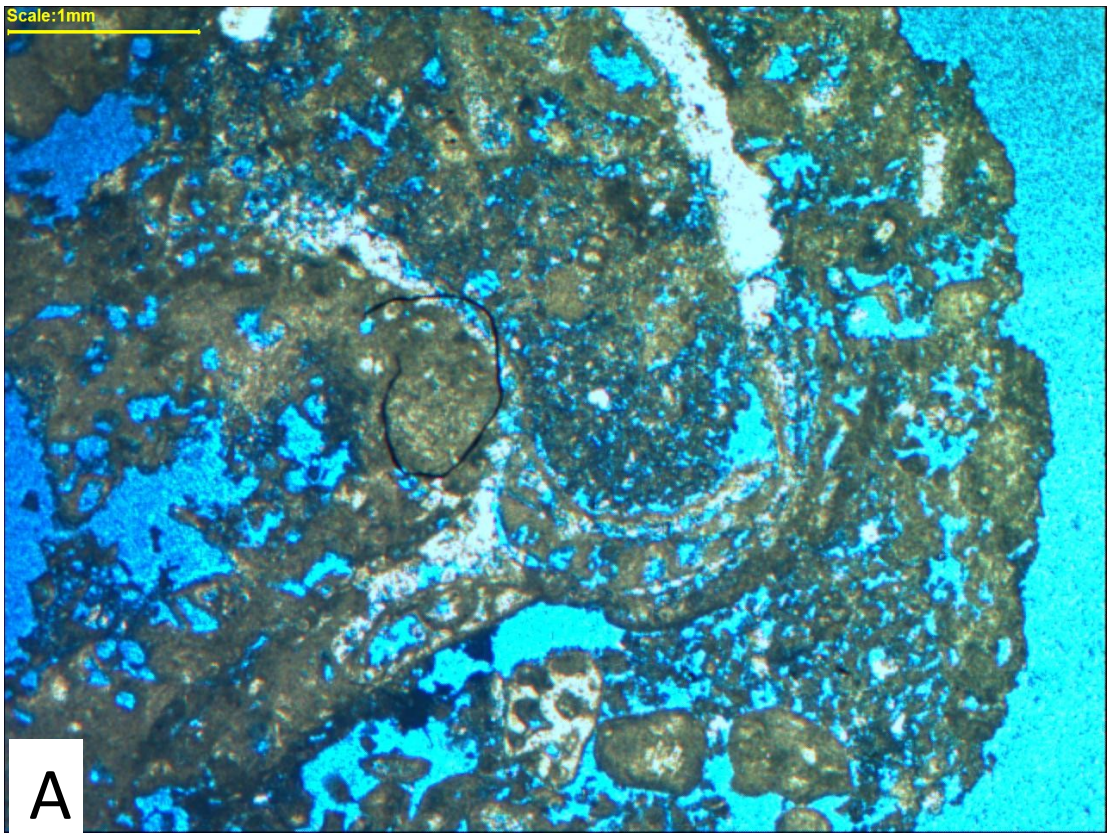


Plate 90

A. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6420.6'. Microbialite pellets from *Lithocodium* microbialite activity on skeletal grains.

B. HMF 4a (low energy, *Lithocodium aggregatum* large oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6422.5'.

Plate 90



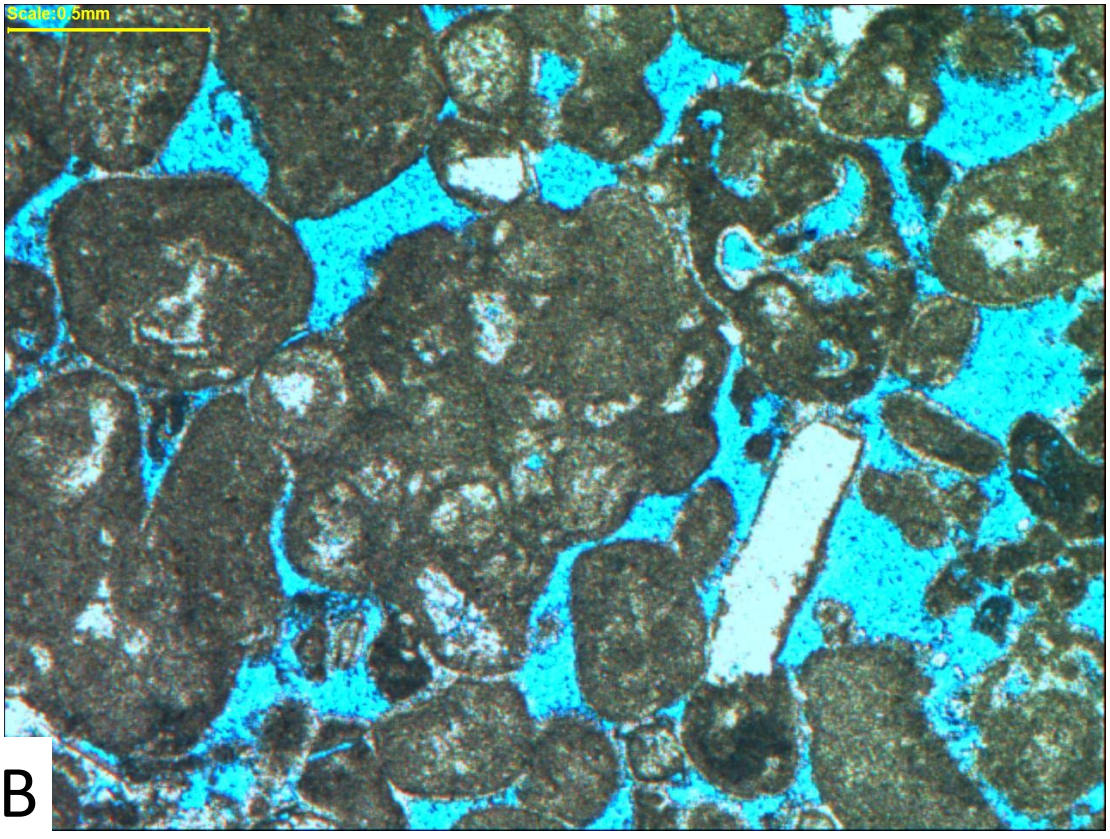
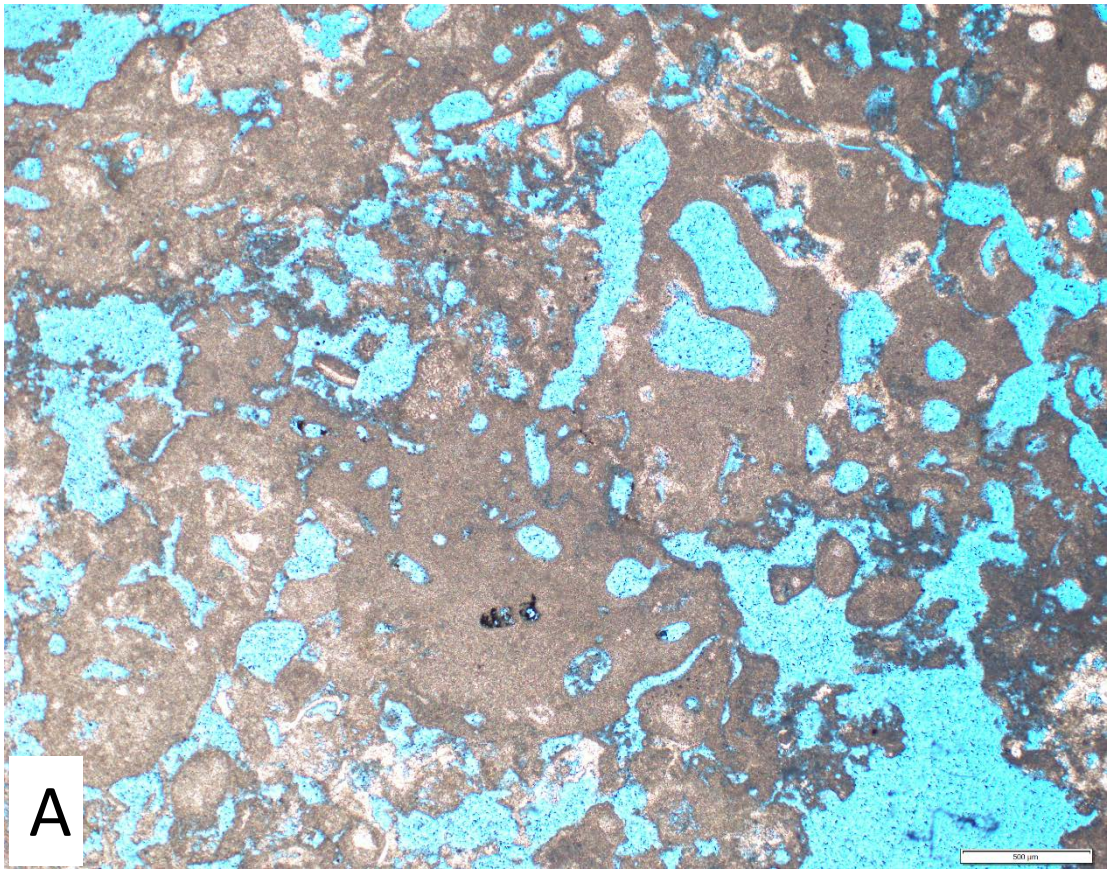


Plate 91

A. HMF 4b (high energy, *Lithocodium aggregatum* smaller oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6404.3‘. This microfacies has potential reservoir quality with intermediate to highly porous moldic (Mo), interparticle (IP) and intraparticle (BP) porosities, with a range of porosity from 5% to 20%.

B. HMF 4b (high energy, *Lithocodium aggregatum* smaller oncoids): *Lithocodium*, Intraclastic and Peloidal Wackestone-Packstone-Grainstone-Rudstone, Well-H, 6404.3‘.

Plate 91



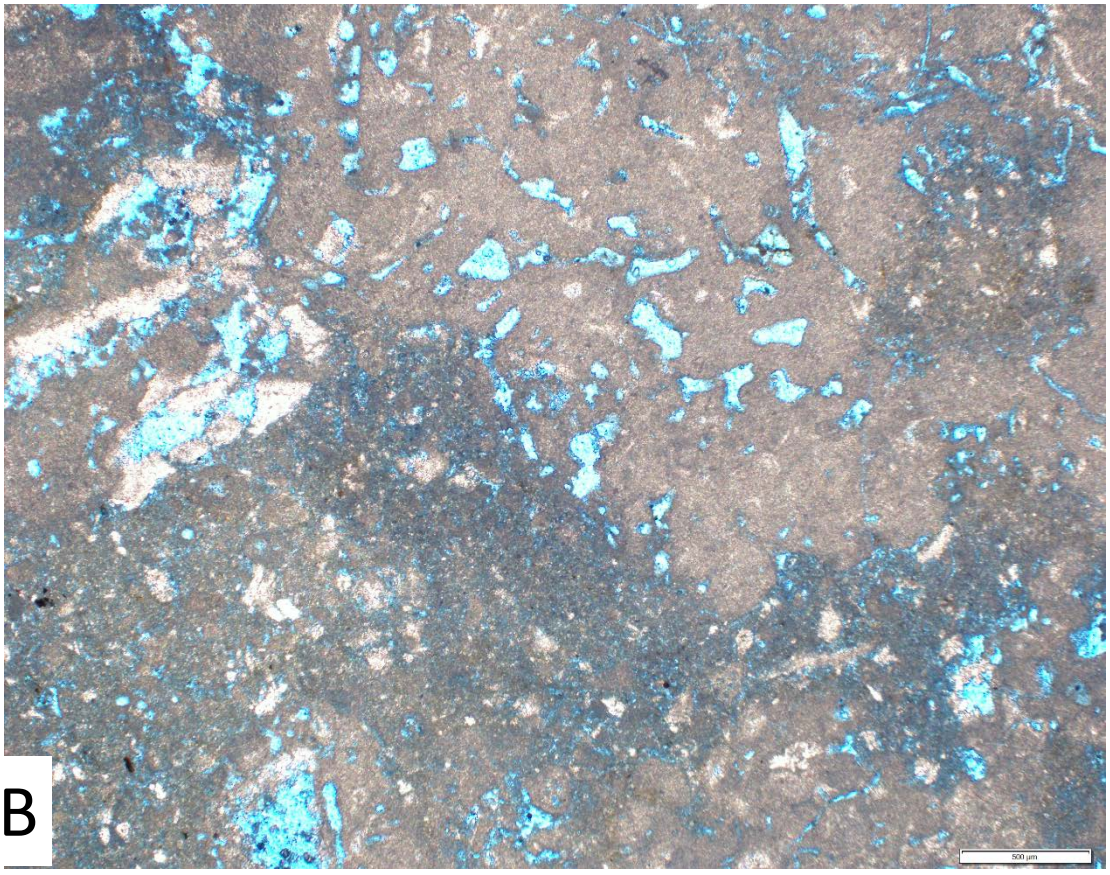
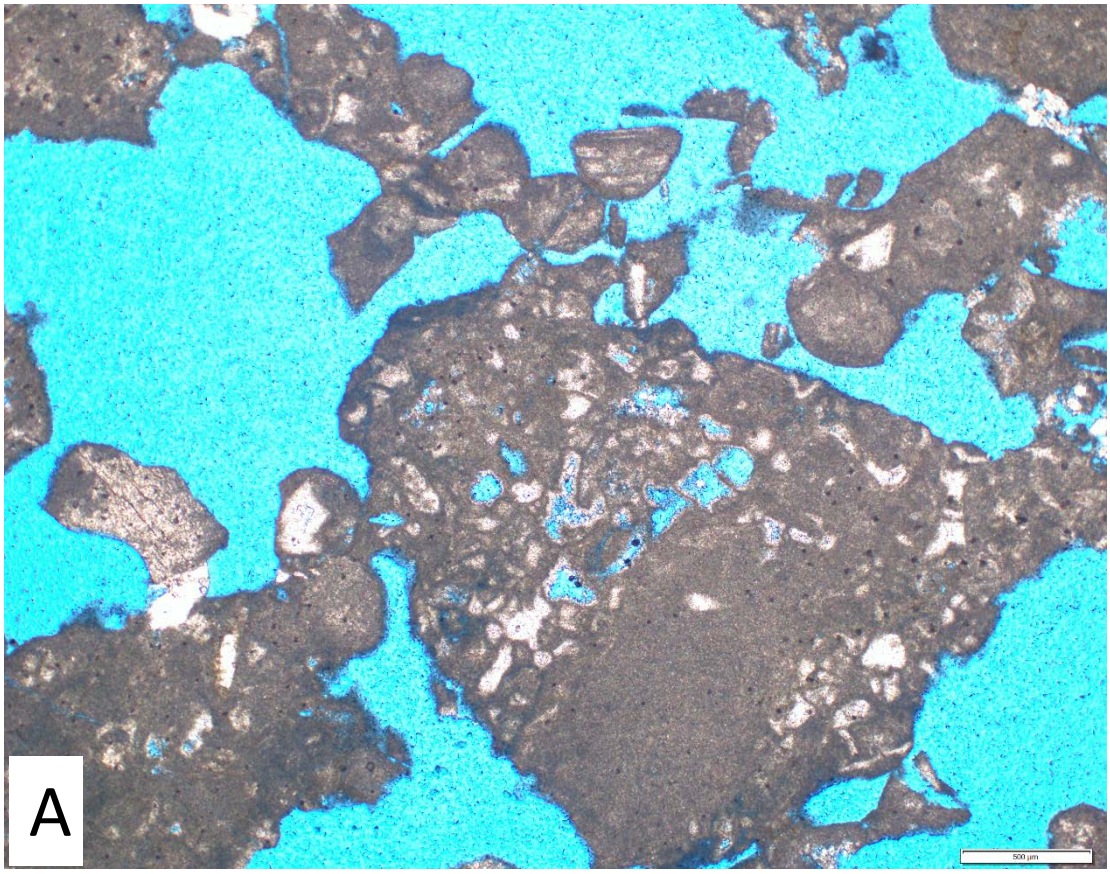


Plate 92

A. HMF 5: *Terebella*, *Crescentiella*, *Ophthalmidium* and Allochthonous Bio-lithoclastic Packstone/Grainstone , Well-H, 6417.6‘. Fine grained packstone and grainstone formed of allochthonous peloids, ooids, coated grains, lithoclastics and allochthonous benthic foraminifera. These are an admixture of reworked sediments transported by gravity flows from both the platform interior and platform margin.

B. HMF 5: *Terebella*, *Crescentiella*, *Ophthalmidium* and Allochthonous Bio-lithoclastic Packstone/Grainstone , Well-H, 6417.6‘. This has has potential reservoir quality with highly porous (~20%) with both interparticle (BP) and intraparticle (IP) porosities.

Plate 92



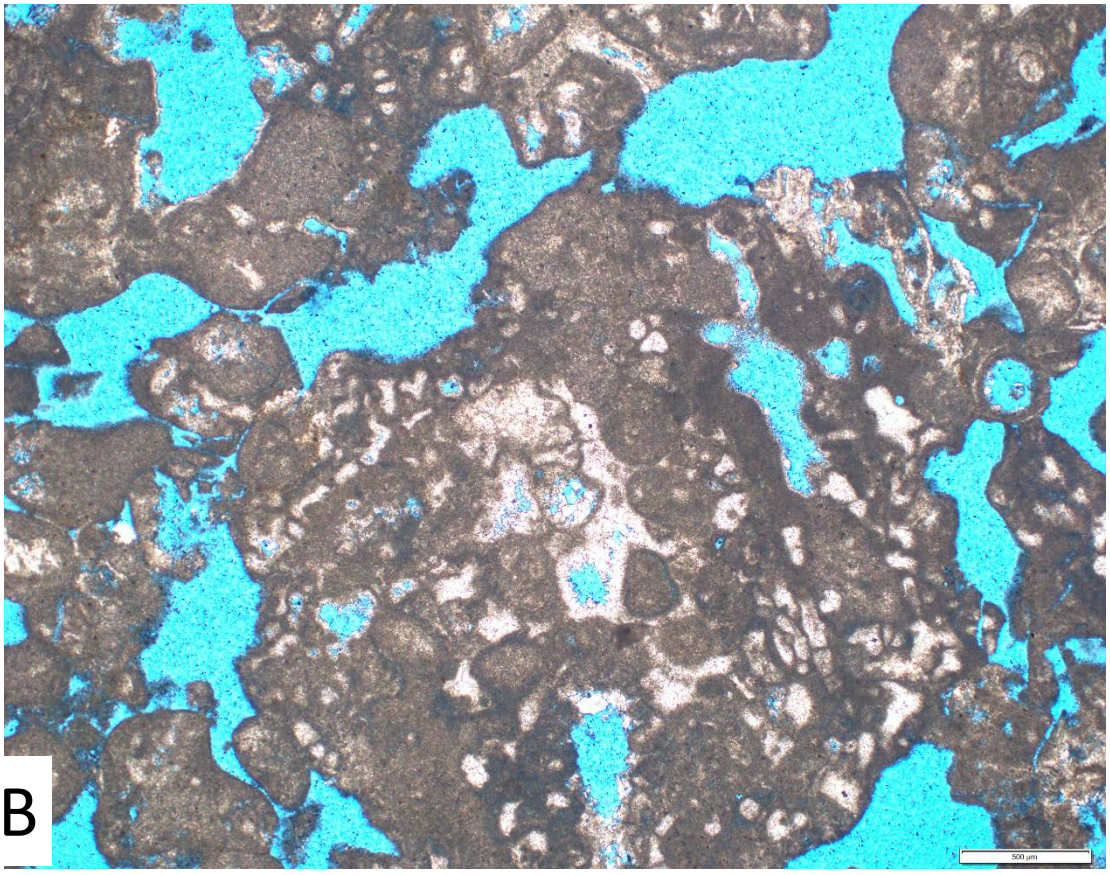
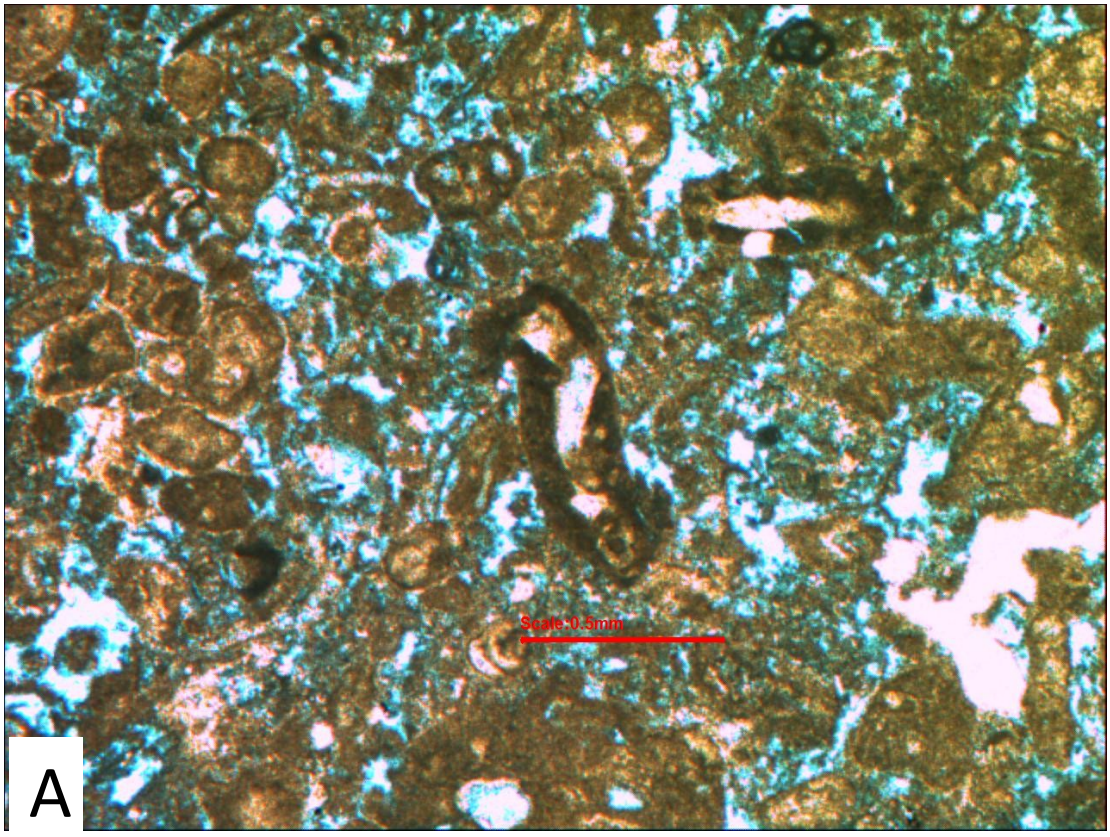


Plate 93

A. HMF 5: *Terebella*, *Crescentiella*, *Ophthalmidium* and Allochthonous Bio-lithoclastic Packstone/Grainstone, Well-B, 8388.8'. *Crescentiella morronensis* forma *morronensis* cortex surrounding *Nodobacularia* sp.

B. HMF 6: Laminated Peloidal Packstone/Grainstone/Bindstone, Well-H, 6408.1'. Fine, very well-sorted peloidal grainstone has a potential reservoir quality with an interparticle (IP) porosity of ~5%.

Plate 93



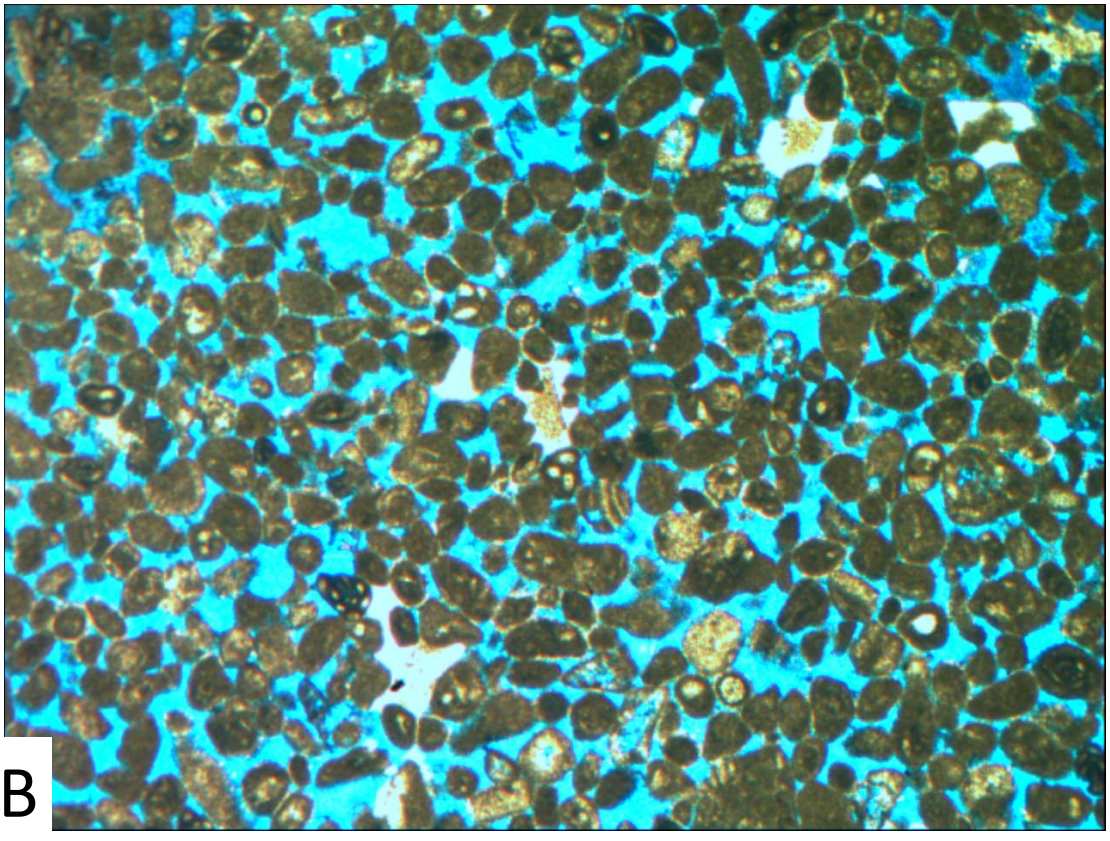
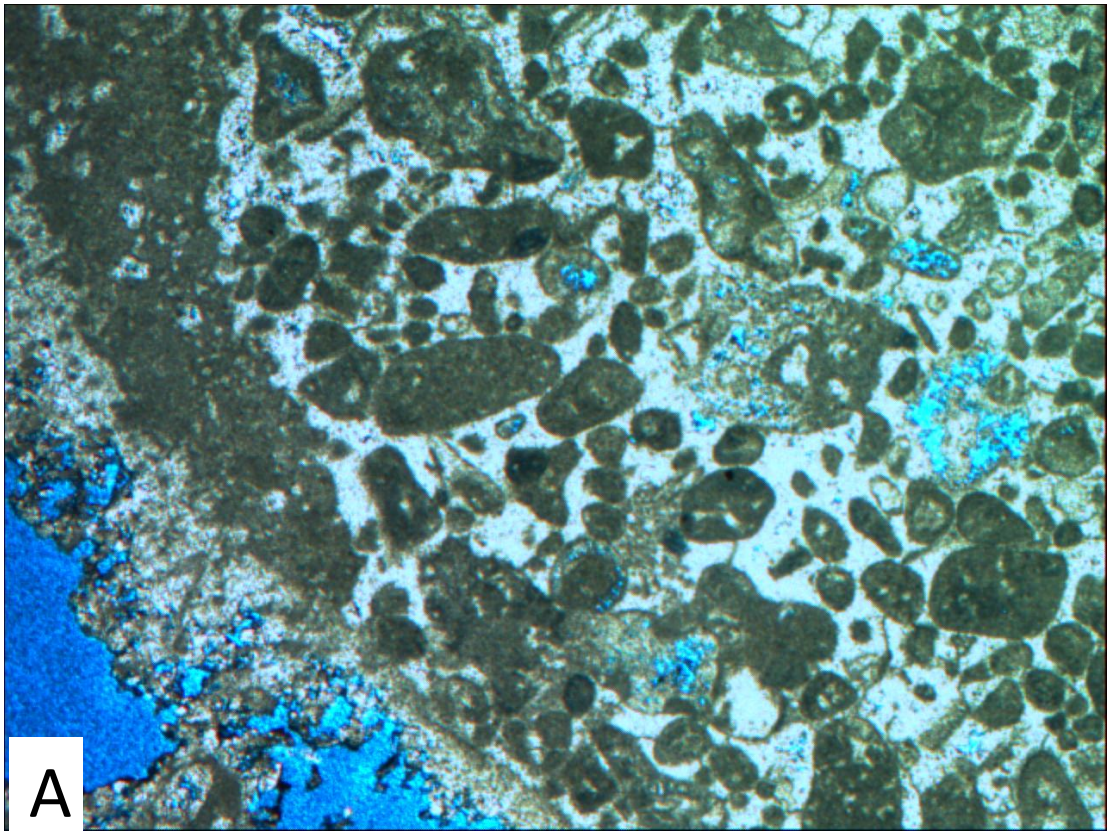


Plate 94

A. HMF 6: Laminated Peloidal Packstone/Bindstone, Well-H, 6406.4’. Encrusting *Lithocodium* piece.

B. HMF 6: Laminated Peloidal Packstone/Bindstone, Well-H, 6405.3’. This microfacies is characterized by alternations of micrite and fine peloidal laminations. It is composed of fine grained packstone and grainstone.

Plate 94



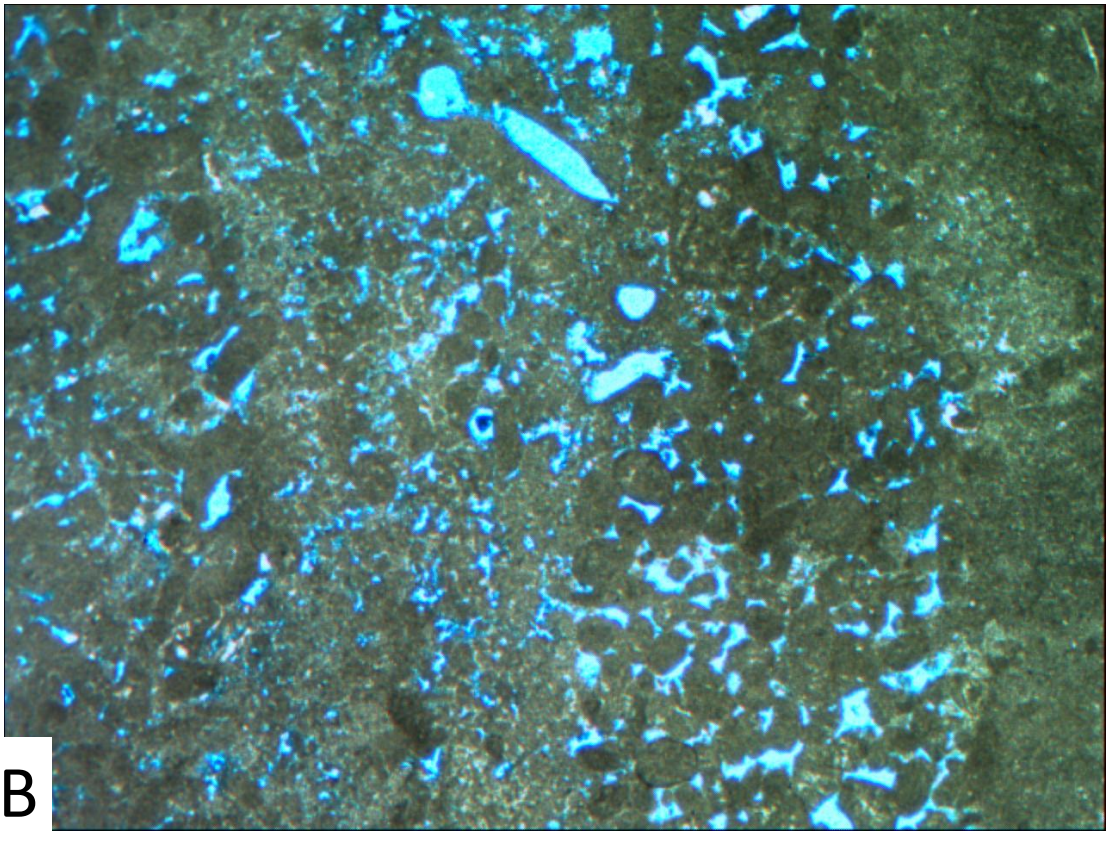
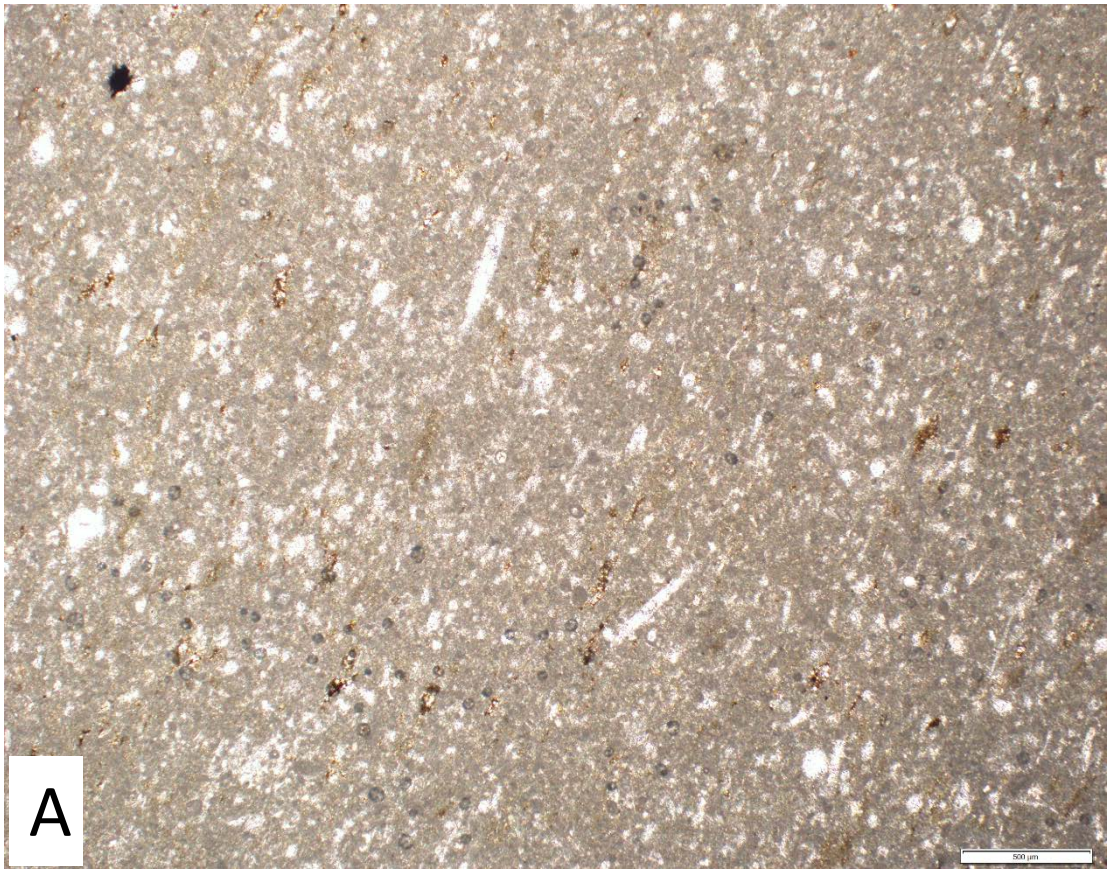


Plate 95

A. DMF 1: Spiculite, Calcisiltite Wackestone, Well-D, 8609.7‘. This microfacies has very poor reservoir quality as it contains no porosity. It is characterised by deeper slope microfossils that includes common echinoderms, triaxon spicules, monaxon spicules, planktonic foraminifera (*Conoglobigerina* sp. cf. *C. gulekhensis*) and calpionellids.

B. DMF 1: Spiculite, Calcisiltite Wackestone, Well-D, 8644.2. This microfacies is characterised by deeper slope microfossils that includes common echinoderms, triaxon spicules, monaxon spicules, planktonic foraminifera (*Conoglobigerina* sp. cf. *C. gulekhensis*) and calpionellids.

Plate 95



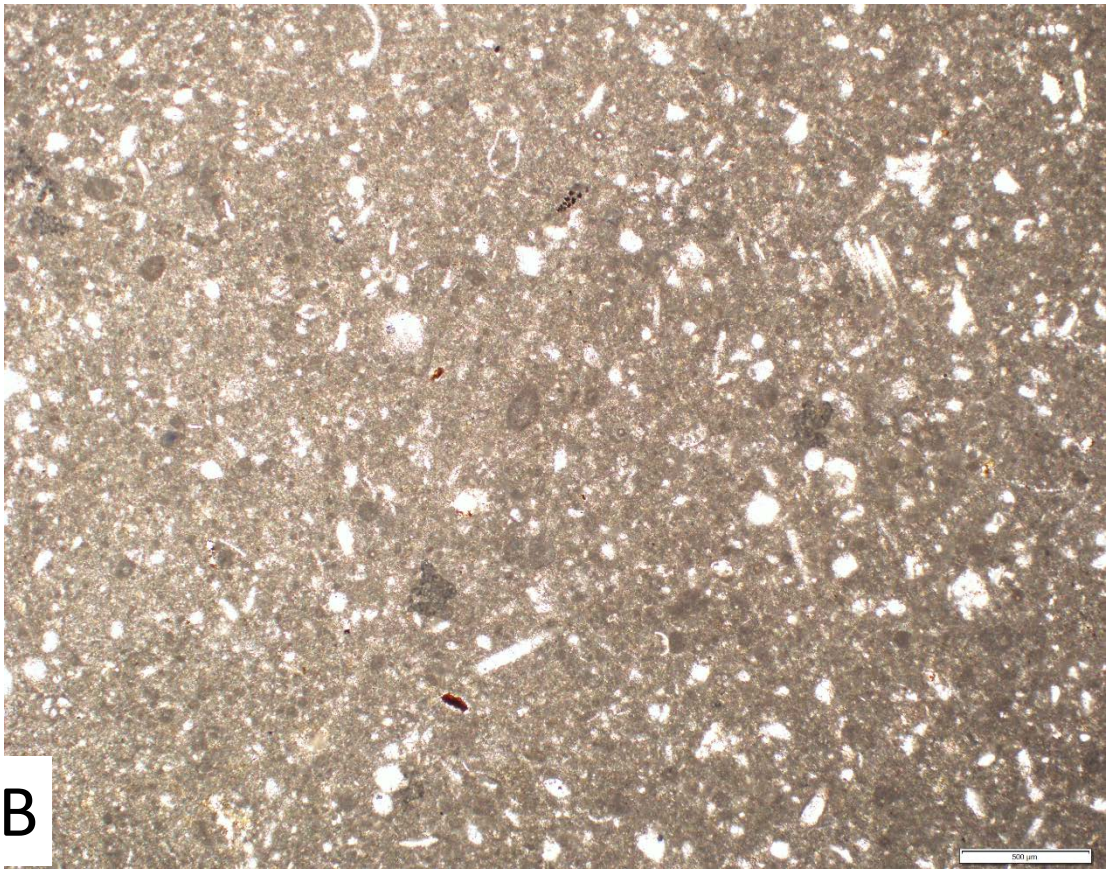
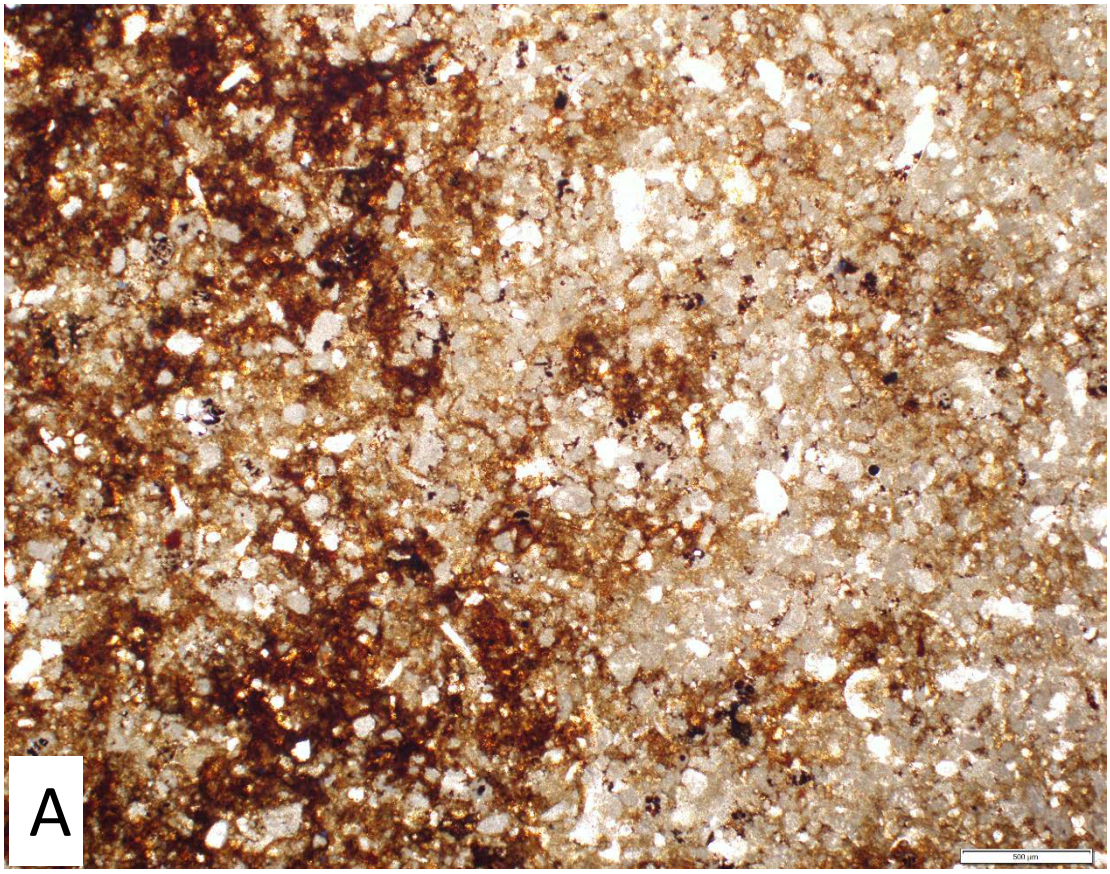


Plate 96

A. DMF 2: Extraclastic, *Nodosaria, Lenticulina* and *Saccocoma* Packstone, Well-D, 8642.7'. It is composed of angular, well-sorted lithoclasts and echinoderm fragments. The main matrix is transported lithoclasts in the form of microbreccia. Oil stains are common and implicating fair porosity. This microfacies has fair reservoir quality as it contains reasonable levels of porosity that is evident from the oil staining (brown colour staining).

B. DMF 2: Extraclastic, *Nodosaria, Lenticulina* and *Saccocoma* Packstone, Well-D, 8642.7'. Higher close-up on the microfacies.

Plate 96



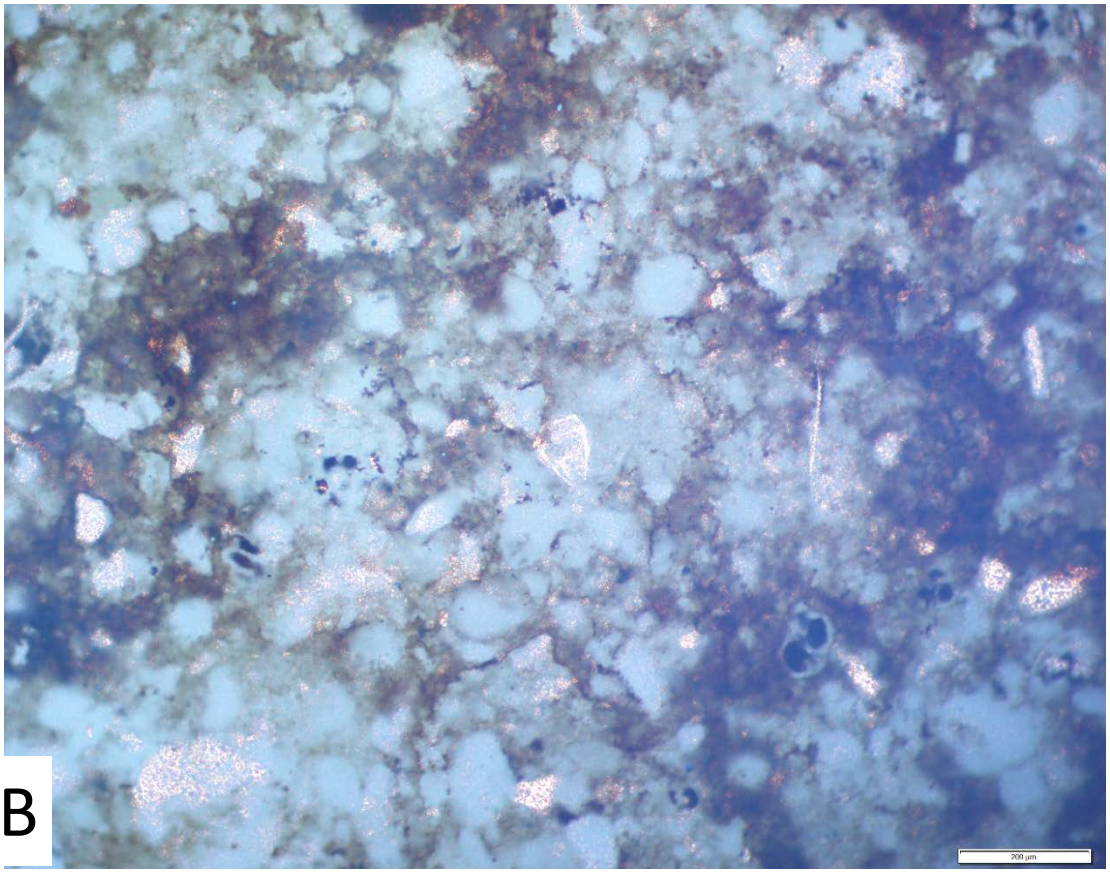
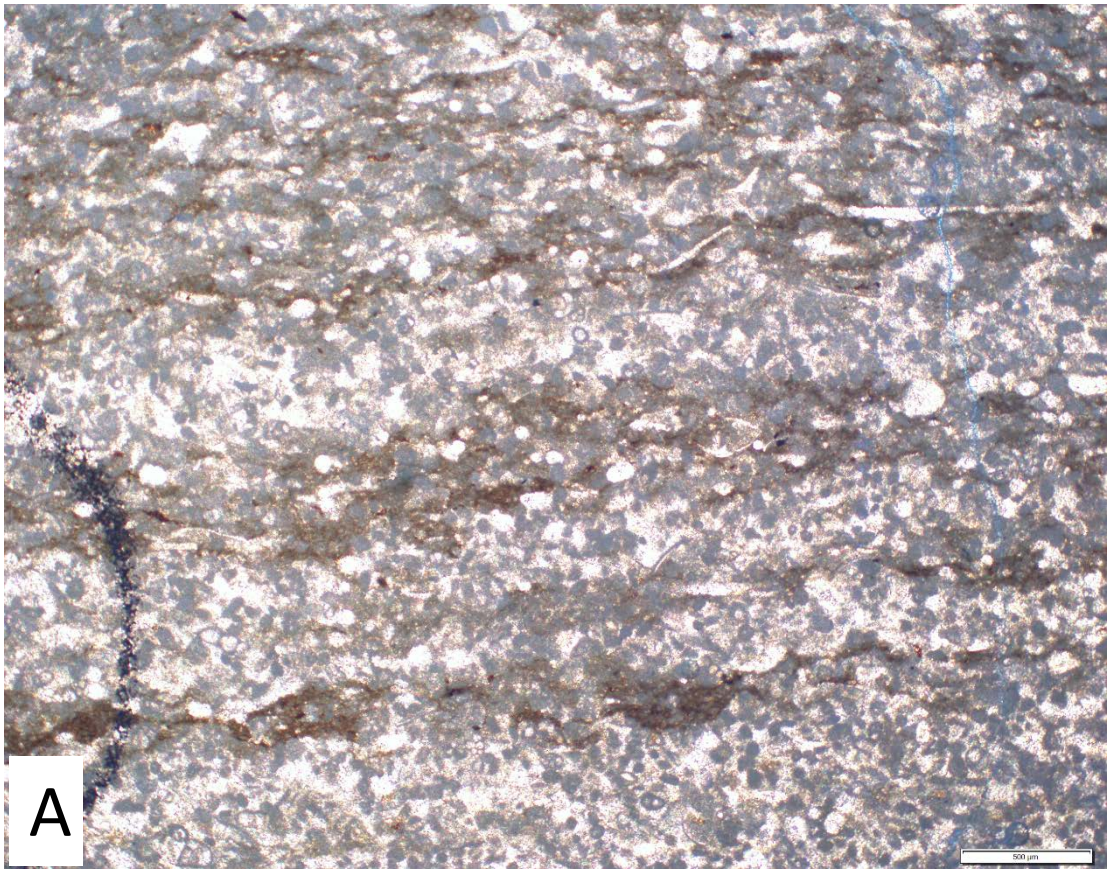


Plate 97

A. DMF 3: Slope-Laminated Peloidal Bindstone/ Wackestone/ Packstone, Well-D, 8635.2’. This microfacies is densely packed and has poor reservoir quality as it contains no visible porosity. Chemical compaction and stylolite are very common.

B. DMF 3: Slope-Laminated Peloidal Bindstone/ Wackestone/ Packstone, Well-D, 8635.2’. It is common planktonic foraminifera (*Conoglobigerina* sp. cf*. C. gulekhensis*).

Plate 97



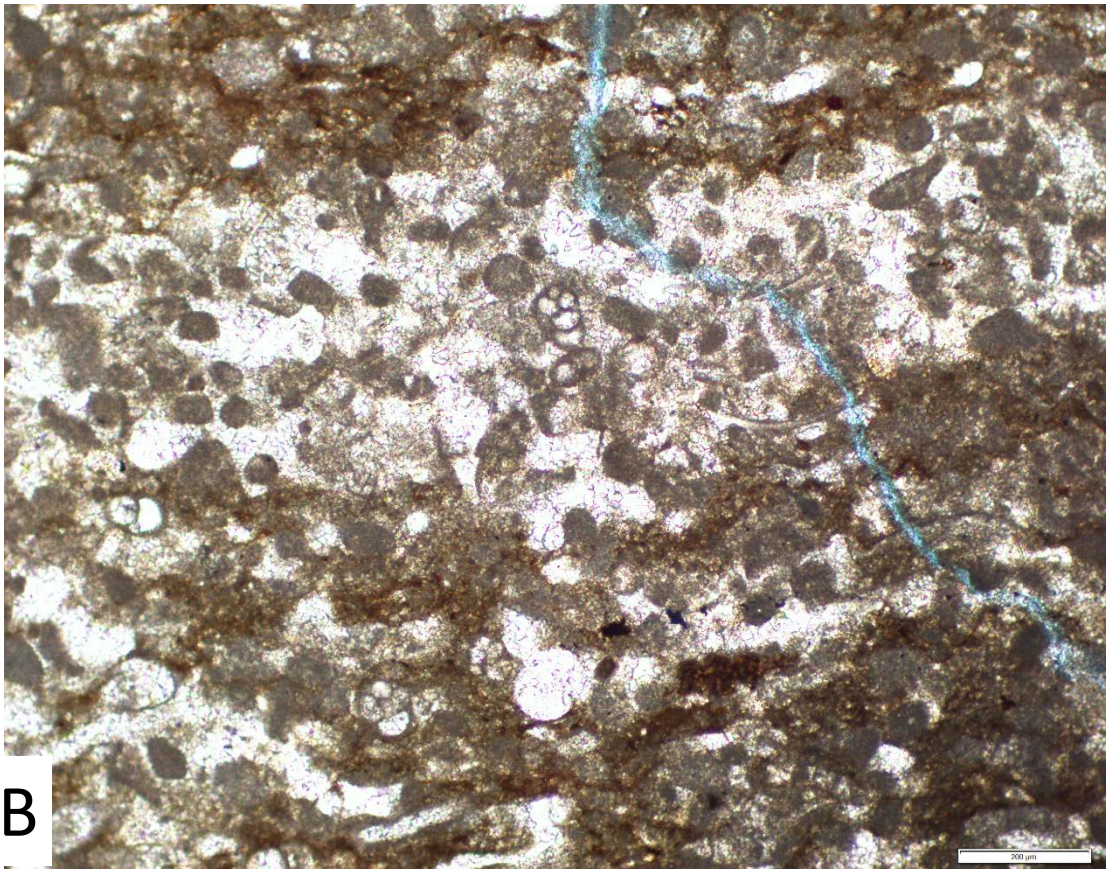
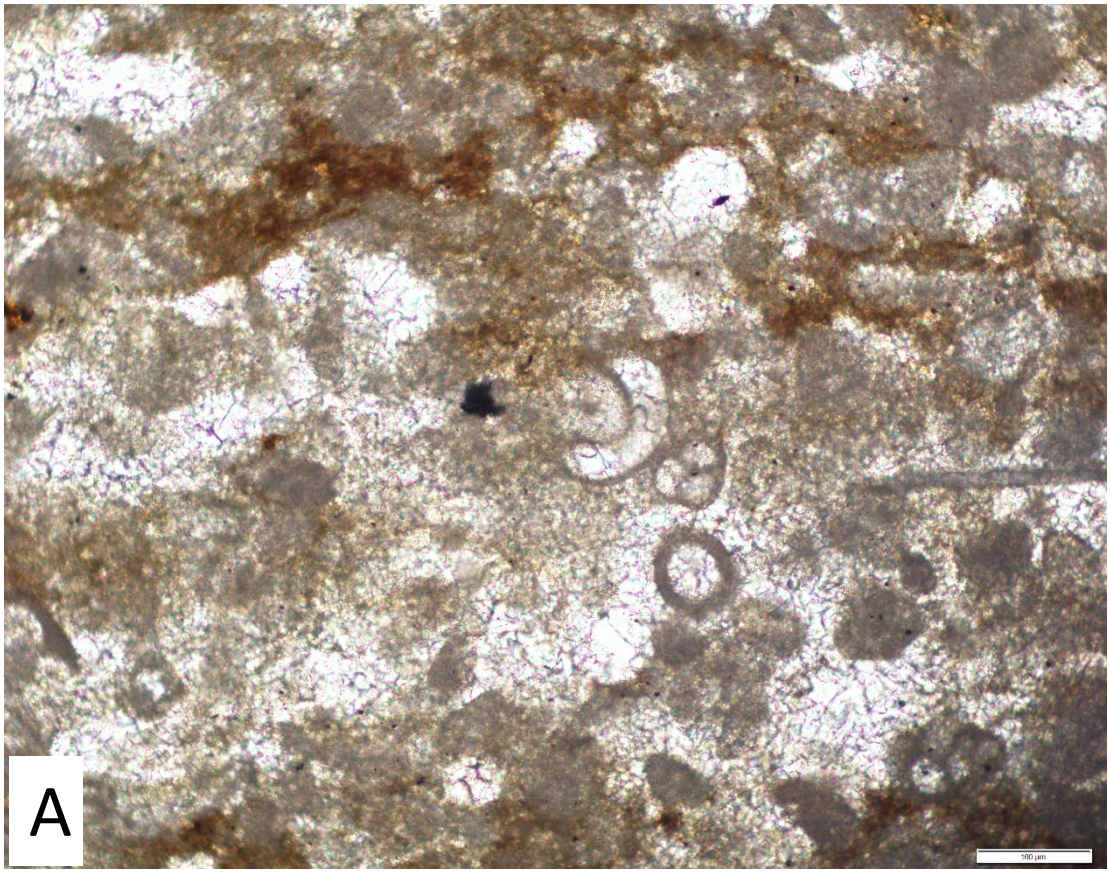


Plate 98

A. DMF 3: Slope-Laminated Peloidal Bindstone/ Wackestone/ Packstone, Well-D, 8635.2'. A close-up view of the planktonic foraminifera (*Conoglobigerina* sp. cf*. C. gulekhensis*).

A. DMF 3: Slope-Laminated Peloidal Bindstone/ Wackestone/ Packstone, Well-D, 8635.2'. A close-up view of the planktonic foraminifera (*Conoglobigerina* sp. cf*. C. gulekhensis*).

Plate 98



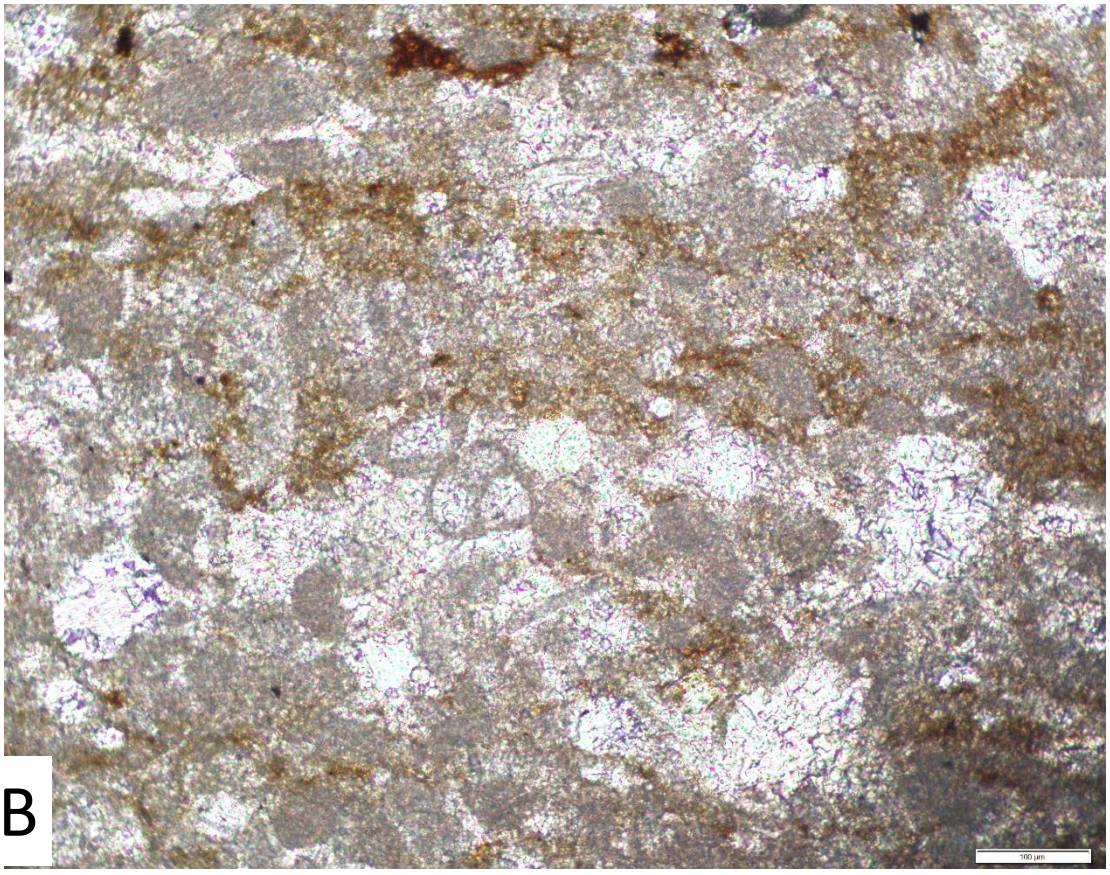


Plate 99

A. DMF 4: *Lenticulina*, Oyster, Peloidal Packstone, Well-D, 8630.7'. The texture is abundant with very well sorted fine peloids and it is the main matrix. This microfacies is characterised by *Lenticulina* spp. and transported Platform Margin microfossils such as gastropods, oyster type of bivalves, echinoderms and agglutinated foraminifera.. The microfacies has poor porosity with (<3%). It is commonly represented by a moldic (MO) porosity.

B. DMF 5: *Lenticulina*, Saddle Dolomite Wackestone, Well-D, 8620.2'. This microfacies texture has mainly that of wackestone. The crystalline saddle dolomite is secondary that has possibly been developed by hydrothermal fluids. The main matrix in this lithofacies is very dolomitic, dense micrite. Solution seams and microstylolites are very common. This microfacies is characterised by slope microfossils that include *Lenticulina* spp., *Nodosaria* spp., *Everticyclammina virguliana* and *Pseudocyclammina lituus*.

Plate 99

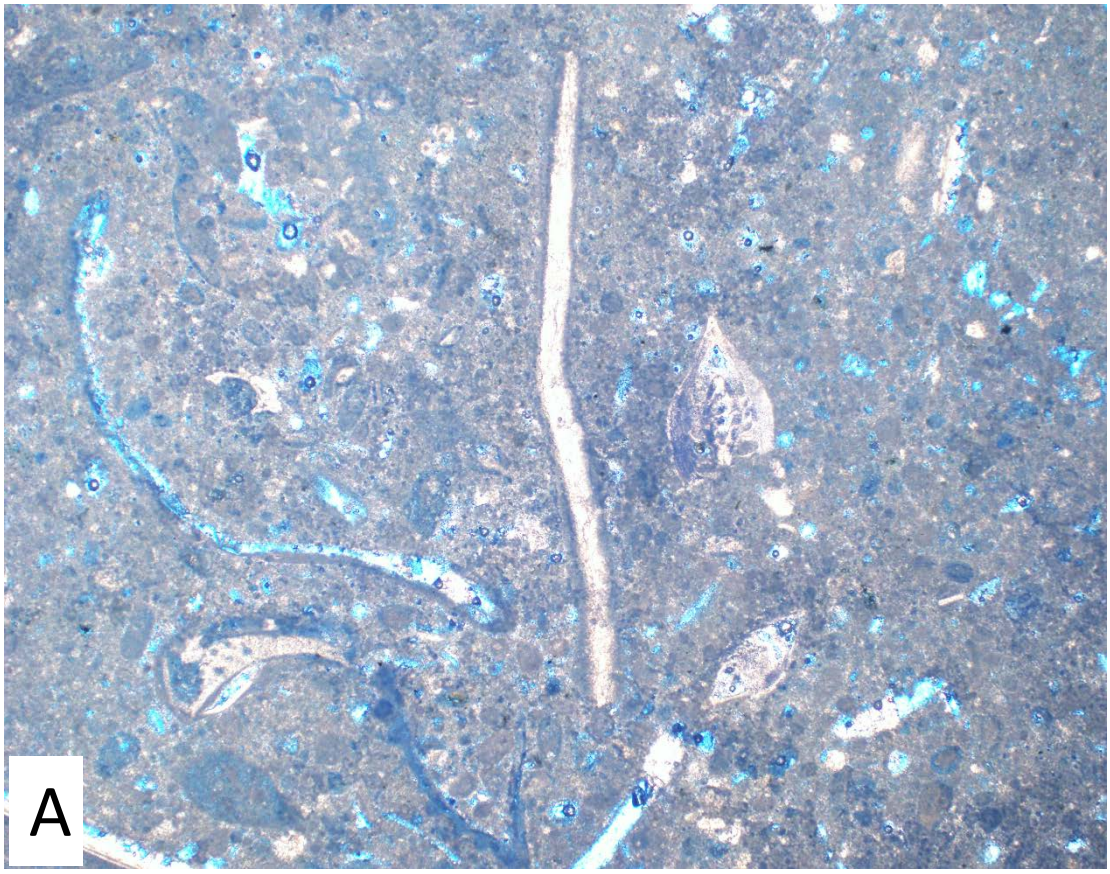
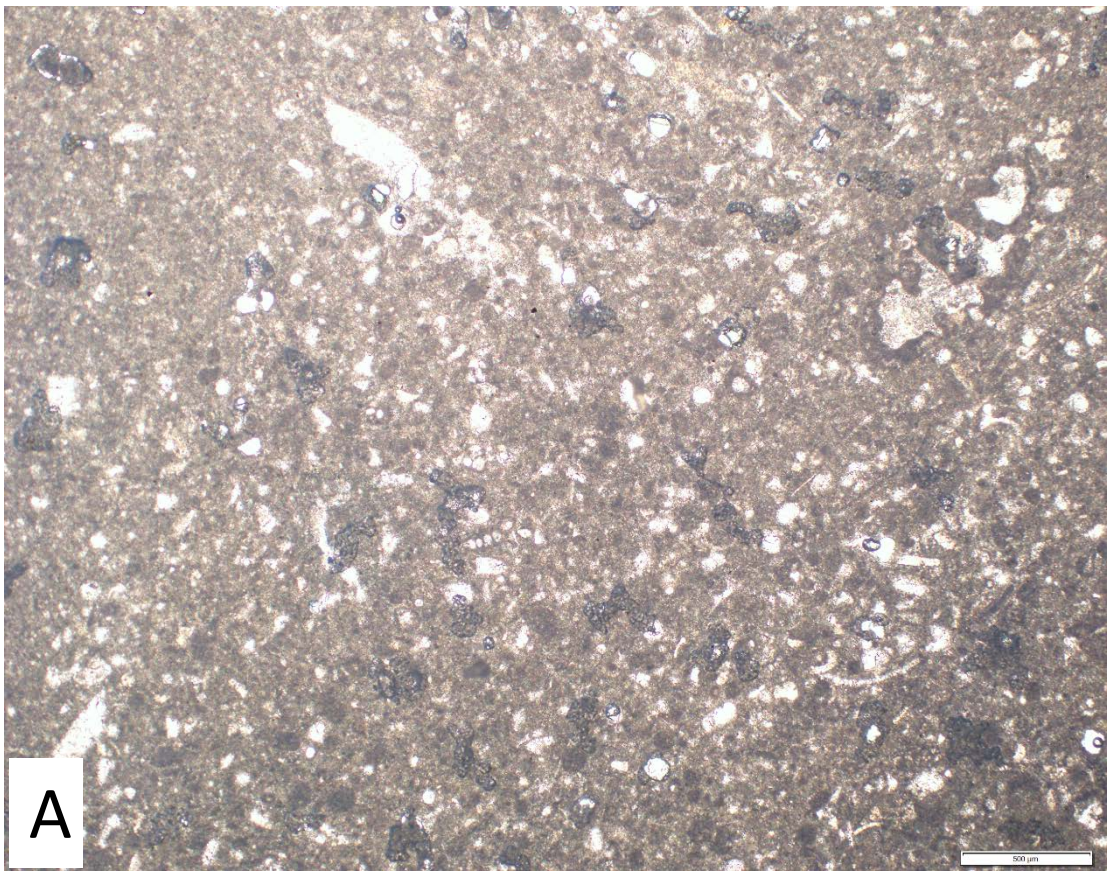


Plate 100

A. DMF 6: *Protopeneroplis*, Peloidal WackestoneWell-D, 8611.2’. This microfacies texture is mainly that of peloidal wackestone. The well sorted fine peloids were created within the back-shoal side of the protected open marine floor and they are probably localised as a result of the very low energy conditions. This microfacies is characterised by sheltered open marine microfossils that is include common gastropods, bivalves, echinoderm fragments, *Protopeneroplis ultragranulata*, *P. lituus* and thin-shelled ostracods.

B. DMF 6: *Protopeneroplis*, Peloidal WackestoneWell-D, 8611.2’. The microfacies has low reservoir quality as it contains no porosity.

Plate 100



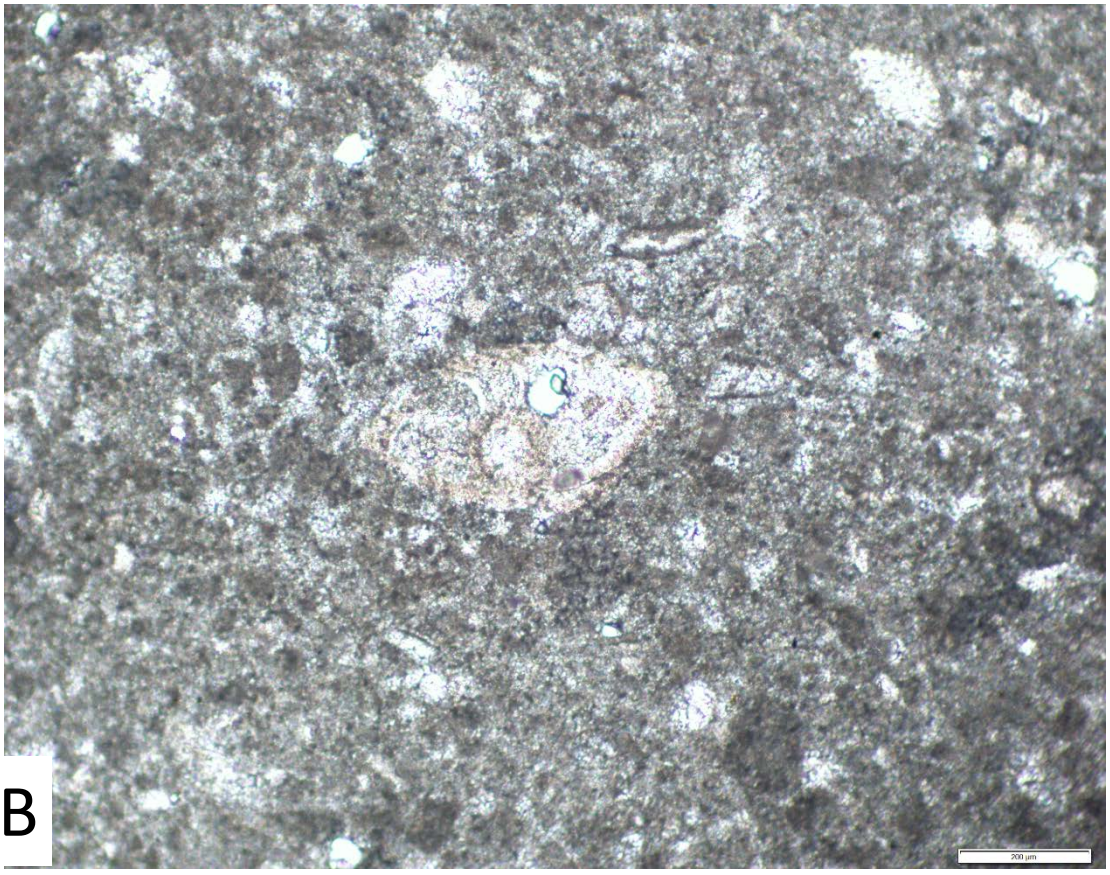
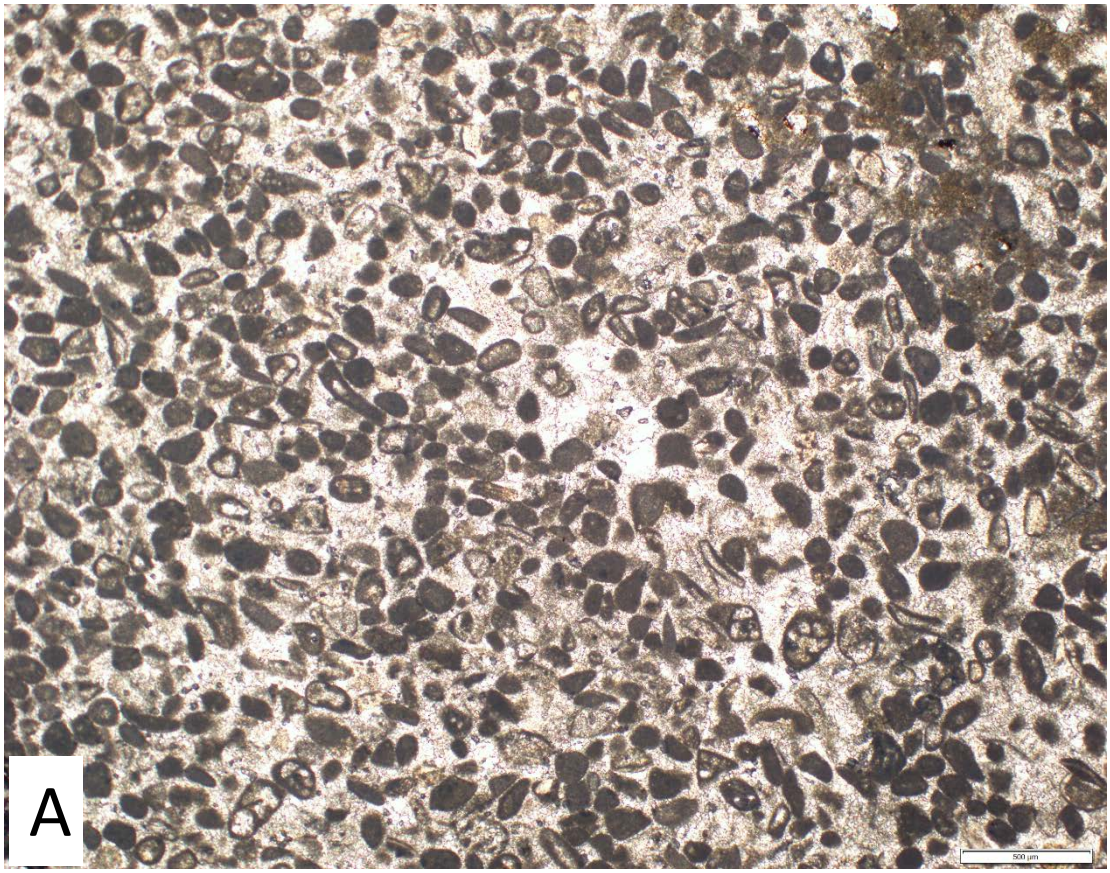


Plate 101

A. DMF 7: Foraminifera, Peloidal Mud-lean Packstone, Well-D, 8584.2’. Texture is almost completely that of a mud-lean packstone. It is mainly formed of very fine and very well-sorted peloids. Bioclastic contents have been coated by micrite envelopes as a result of microbial activity. The reservoir quality is poor as a result of the calcite cemented fabric

B. DMF 7: Foraminifera, Peloidal Mud-lean Packstone, Well-D, 8584.2’. This microfacies is characterised by inner-shoal foraminifera with high diversity. It contains abundant, and variable, miliolids and other benthic, agglutinated foraminifera.

Plate 101



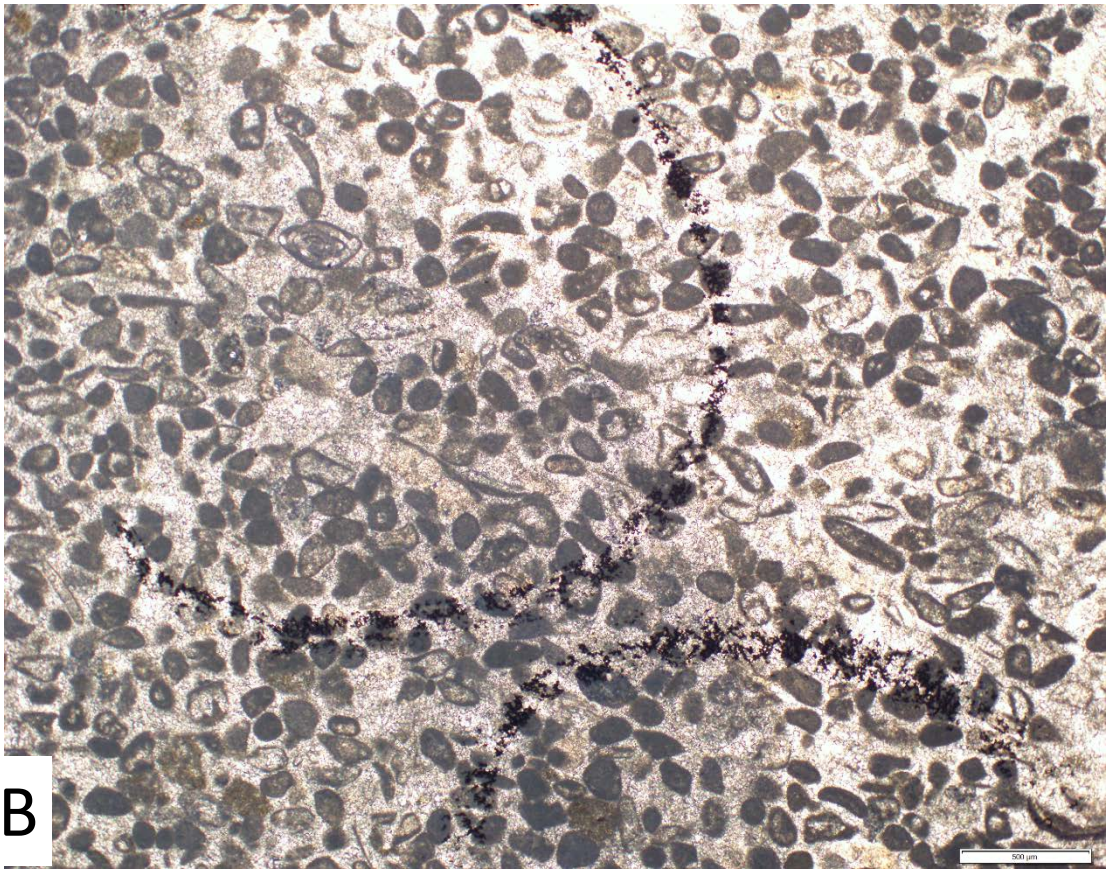
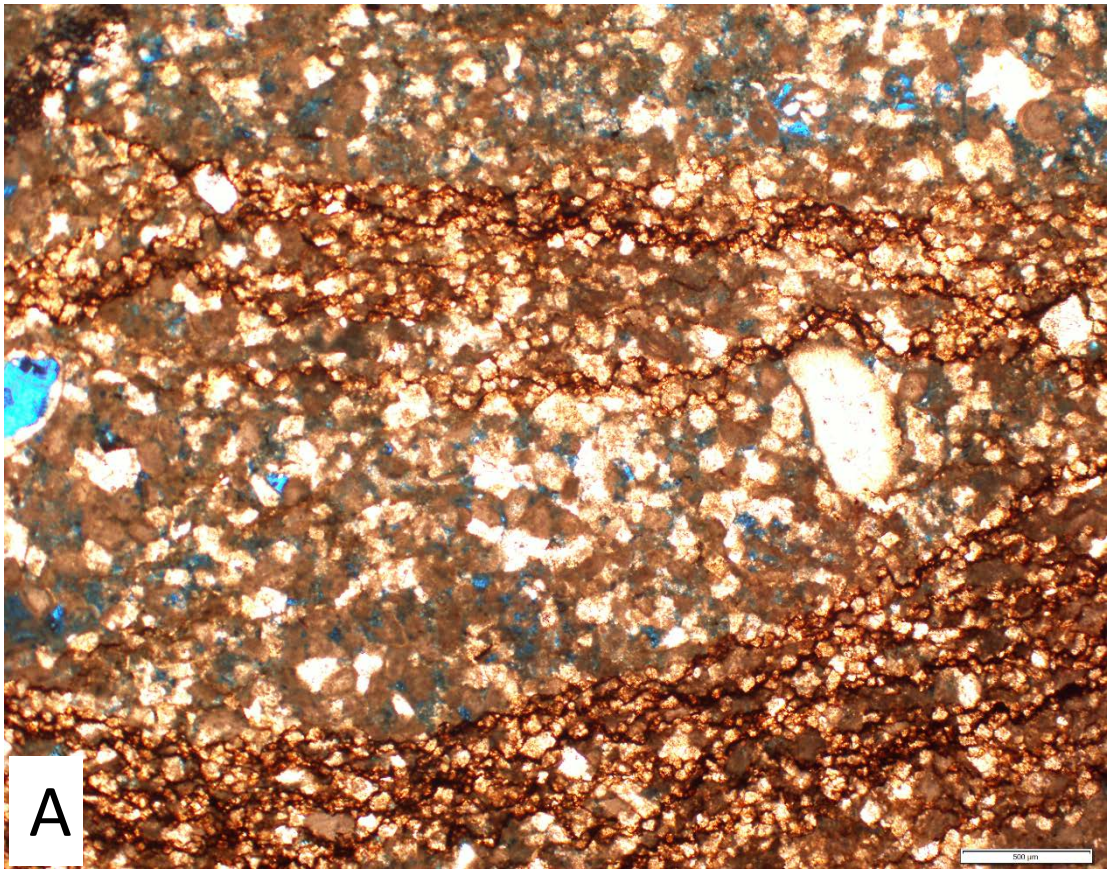


Plate 102

A. DMF 8: *Nodosaria*, Peloidal Microstylolitic/Dolomitic Grainstone /Bindstone, Well-D, 8563.2'. This microfacies is characterized by alternations of dolomitic, microstylolitic laminae with very well-sorted, fine peloidal laminations. Texture is mainly that of a peloidal grainstone, where peloids and dolomite crystals are the main constituents. This microfacies has common signs of chemical dissolution and compaction. The microfacies has poor to fair porosities (~ 3%). The porosities have been destroyed by the chemical compaction and the stylolites. These laminae are densely packed and this results in poor reservoir quality; there is no visible porosity.

B. DMF 8: *Nodosaria*, Peloidal Microstylolitic/Dolomitic Grainstone /Bindstone, Well-D, 8563.2'. The most important recorded microfossil is *Nodosaria* spp.

Plate 102



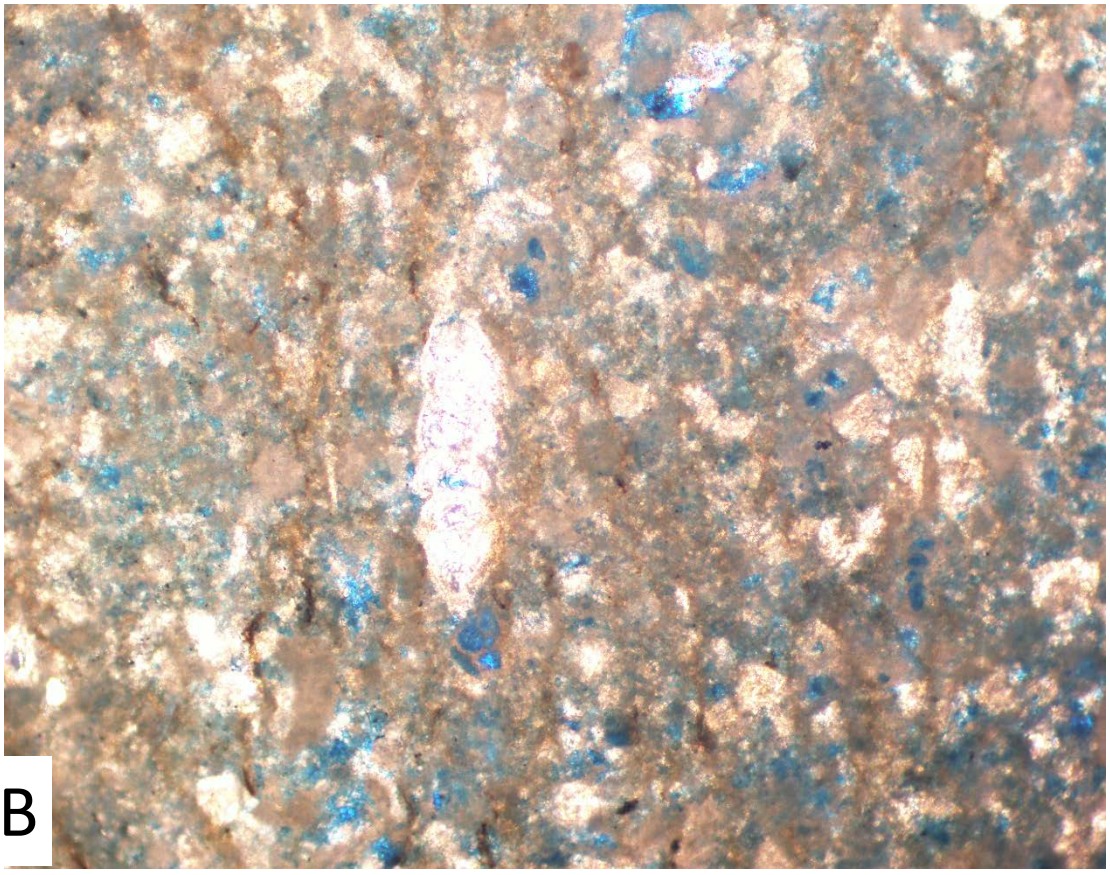
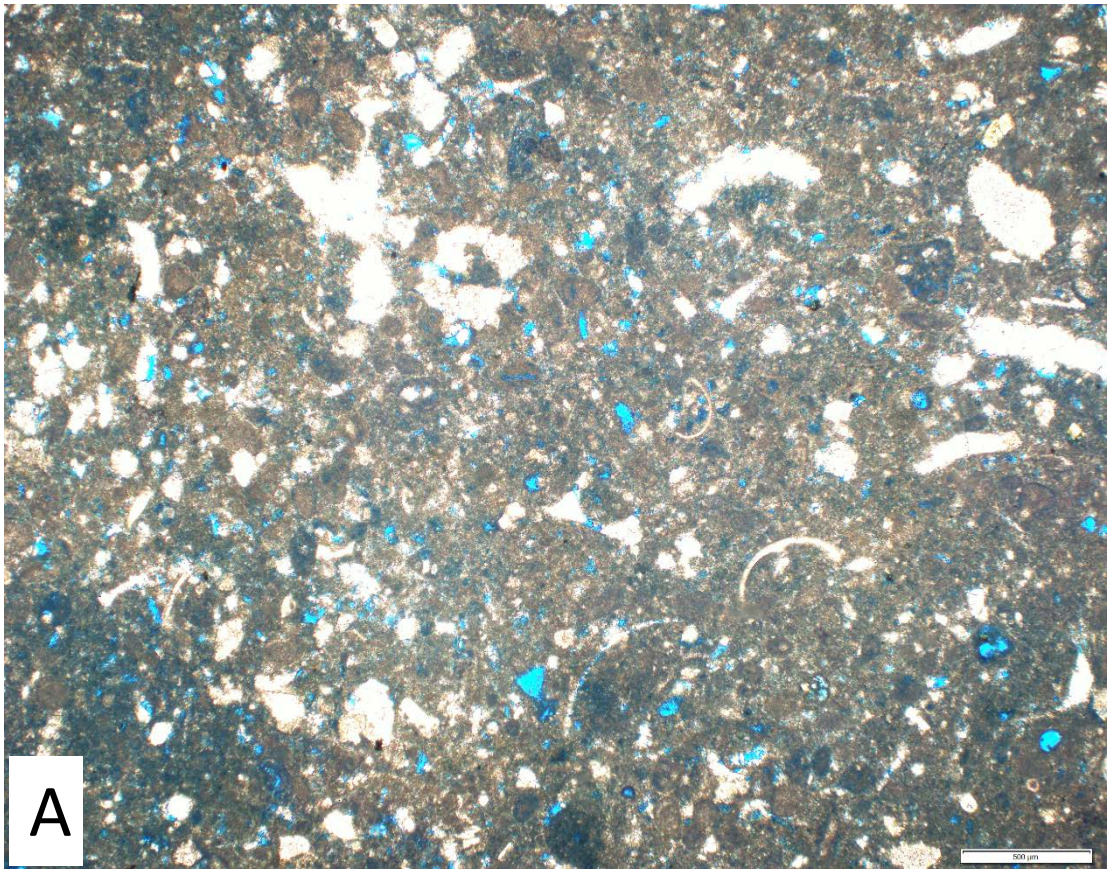


Plate 103

A. DMF 9: Peloidal, Reworked-Skeletal Wakestone, Well-D, 8558.7'. This microfacies texture is mainly that of wakestone. Transported and reworked peloids and skeletal fragments are the main constituents. Planktic foraminifera (*Conoglobigerina* sp. cf. *C. gulekhensis*), are relatively common. The microfacies is characterised by (IP) inter-particle porosity ranging from 3 % - 15%.

B. DMF 10: *Conoglobigerina* sp., Extraclastic, Peloidal Wakestone, Well-D, 8542.2'. This microfacies is that of wackestone and it is abundant with well sorted fine peloids. The lithofacies is characterised by very poor moldic (Mo) porosity.

Plate 103



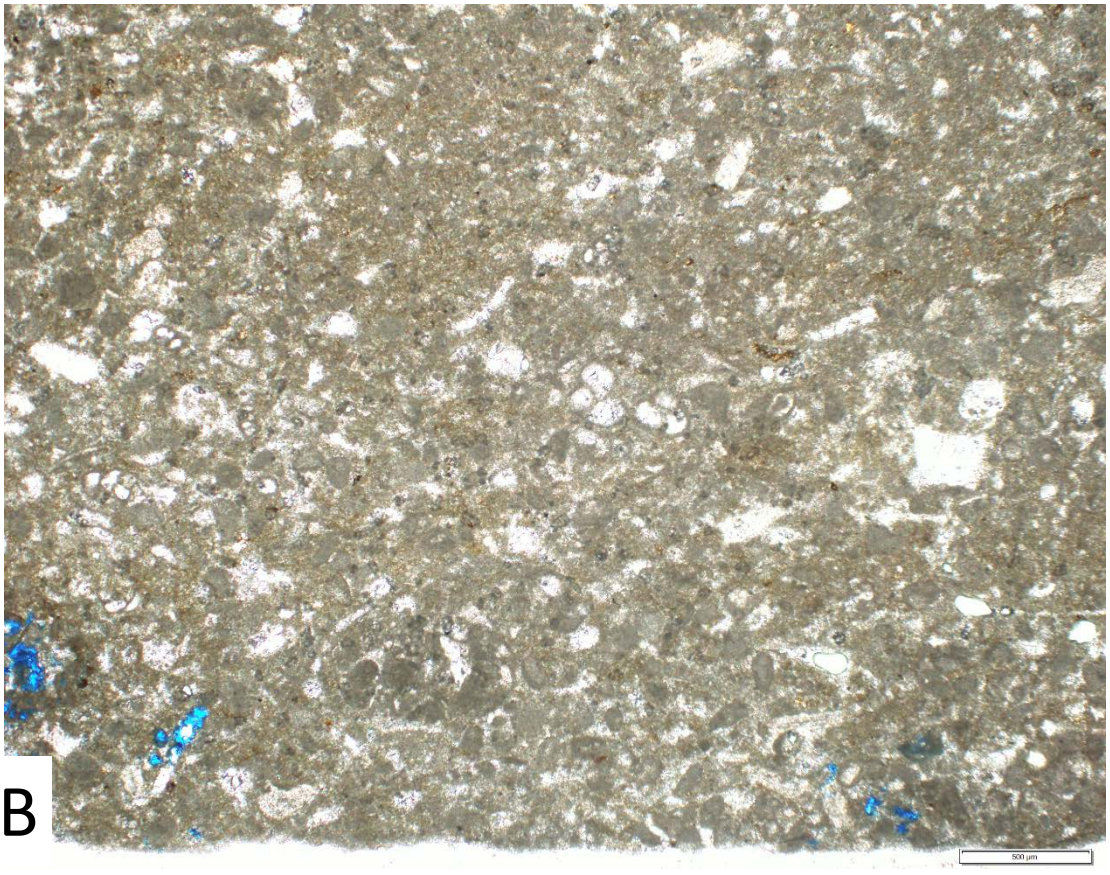
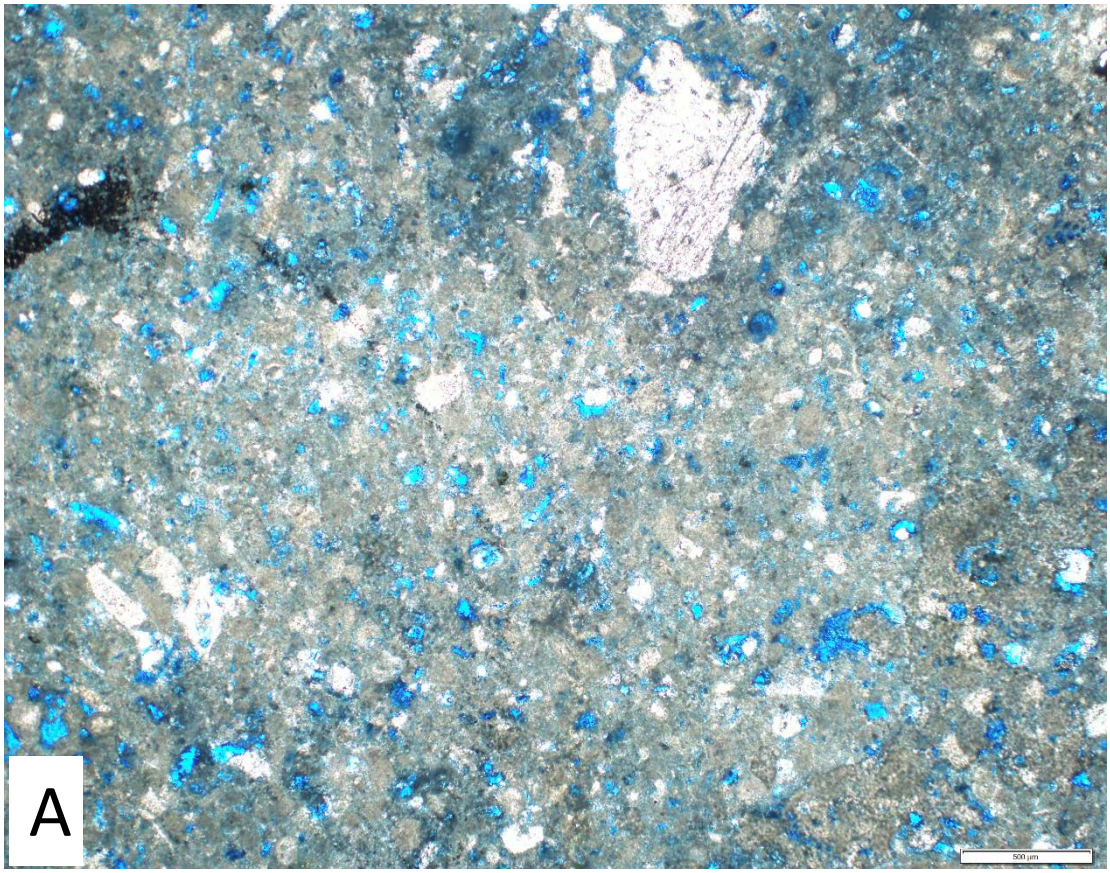


Plate 104

A. DMF 11: *Lenticulina*, Peloidal Wackestone to Packstone , Well-D, 8540.7'. This microfacies texture is mainly that of wackestone. The main matrix in this lithofacies is micrite that is abundantly recorded with moldic porosity. It is characterised by the presence of very well-sorted peloids that were created within the lagoon floor.

B. DMF 11: *Lenticulina*, Peloidal Wackestone to Packstone , Well-D, 8540.7'. This microfacies is characterised by slope microfossils that include common *Lenticulina* spp ; very common fragments and debris of molluscs and echinoderms; rare polymorphinids; and commonly transported *Nautiloculina* spp. from the lagoonal environment.

Plate 104



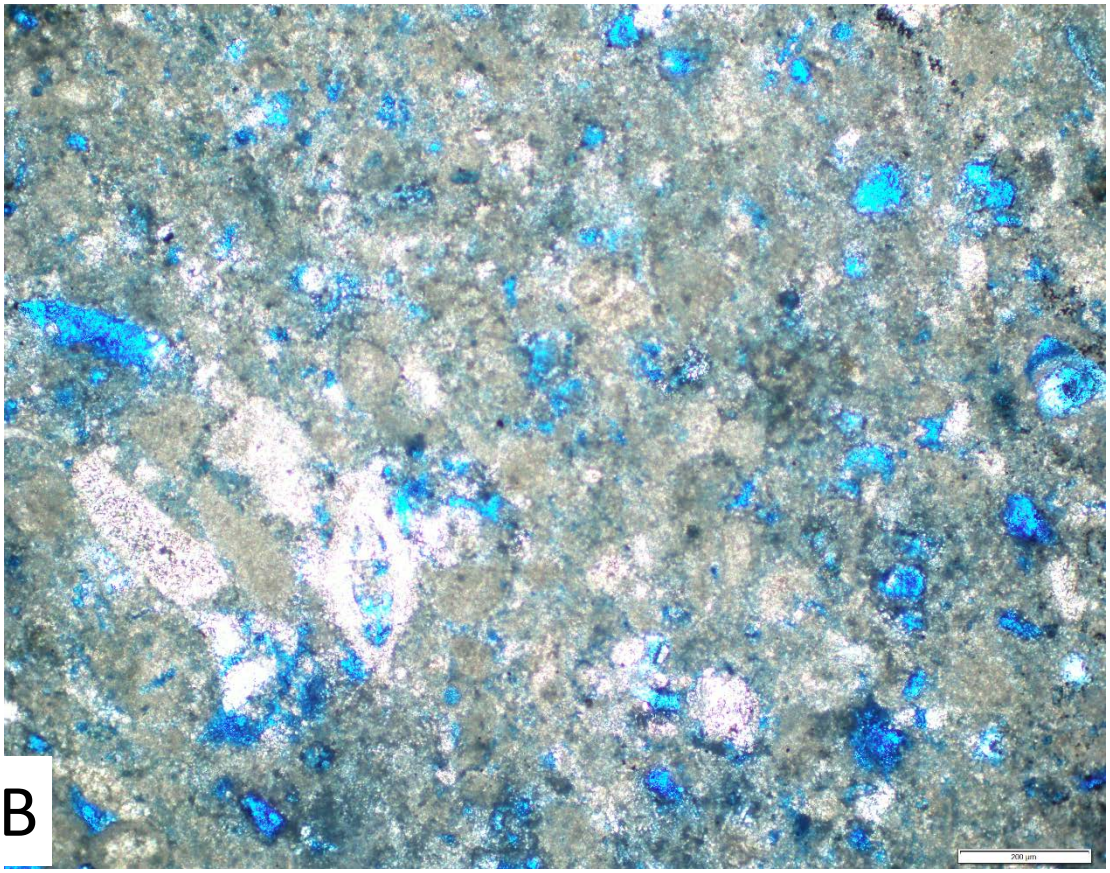
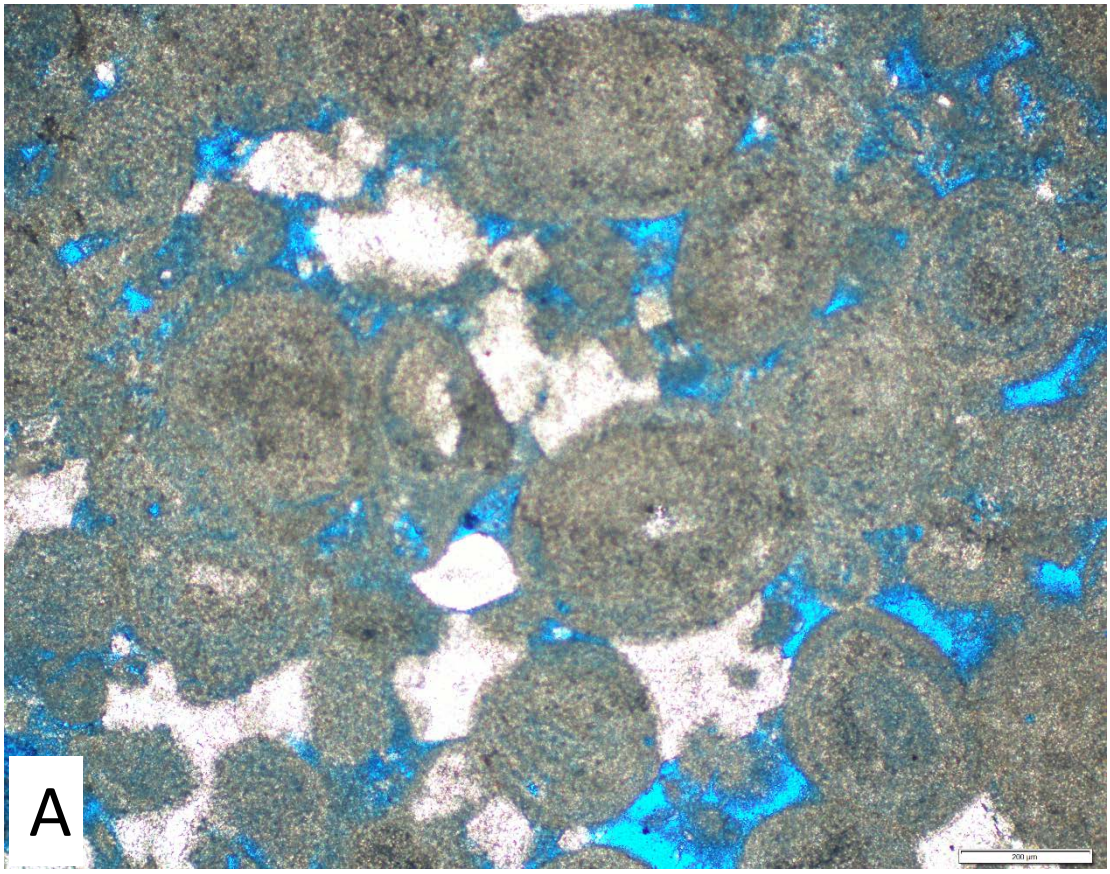


Plate 105

A. DMF 12: Superficial Ooid Grainstone , Well-D, 8406.2’. The main matrix is micritized concentric ooids with an abundant syntaxial cement growth surrounding echinoderm plates. Well-sorted concentric ooids have been created within the shallow shoal and attributed to the very high energy conditions and the agitation of waves and currents within the platform sand bank. This microfacies has very good reservoir quality in which it contains interparticle (IP) porosity ranging from 15% to 25 %. Meniscus cements, suggesting emergence, are formed in this environment by a relatively sharp fall in sea level.

B. DMF 13: Leached Superficial Ooid Grainstone, Well-D, 8410.7’. The main matrix is leached concentric ooids that is characterised by an abundant syntaxial cement growth surrounding echinoderm plates. This microfacies has very good reservoir quality in which it contains moldic (MO) and interparticle (IP) porosity above 25 %. This is may indicate a subaerial exposure surface and possibly a sequence boundary.

Plate 105



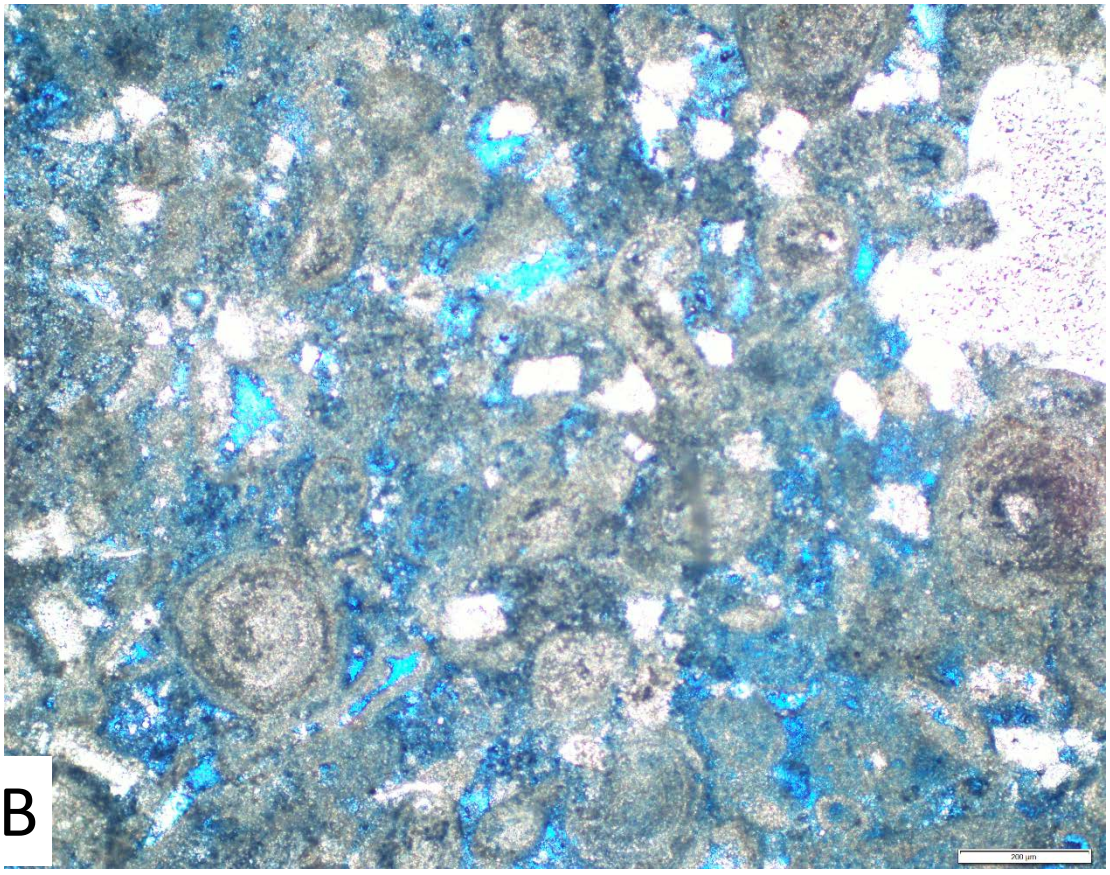
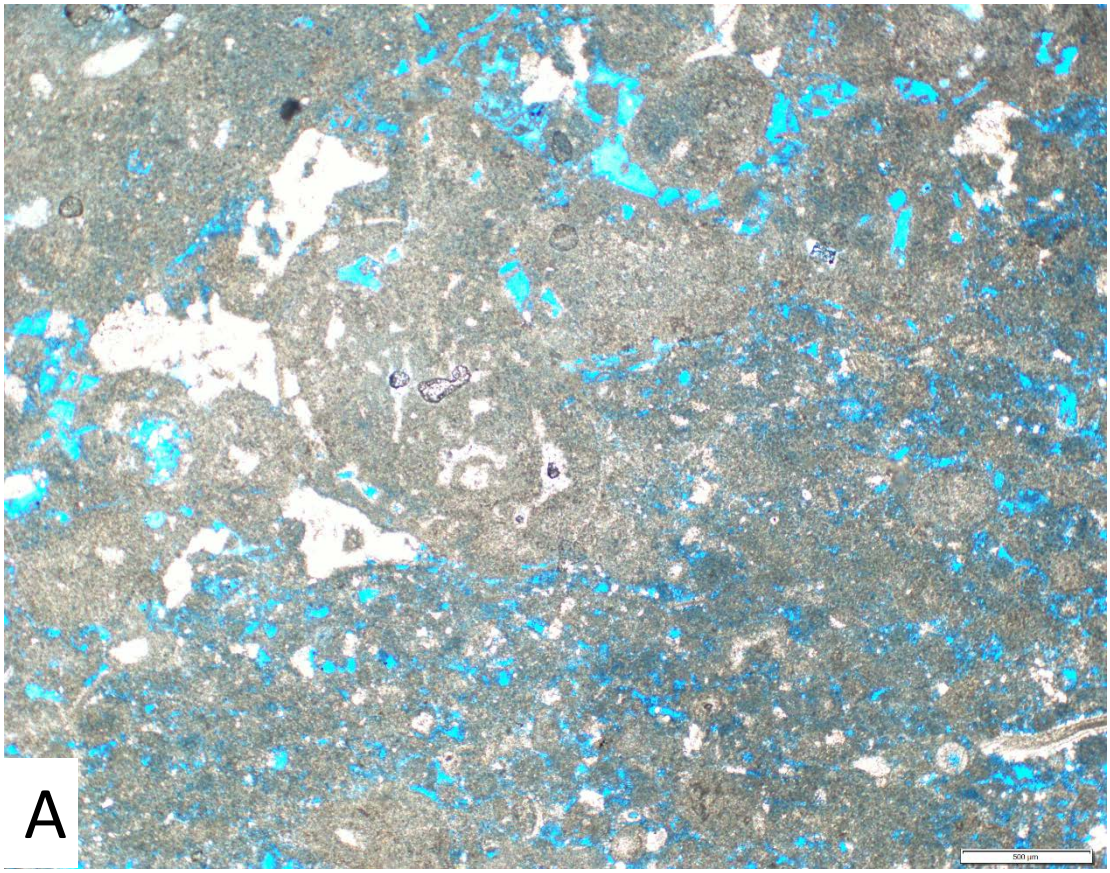


Plate 106

A. DMF 14: Peloidal, Coated Bioclastics Packstone and Grainstone, Well-D, 8392.7'. This microfacies texture is mainly that of packstone and grainstone. Micritised peloids, ooids and coated skeletal fragments are the main constituents in association with common rounded lithoclasts and microbial micritization. This microfacies has very good reservoir quality in which it contains moldic (MO) and interparticle (IP) porosity ranging from 10 to 25 %.

B. DMF 14: Peloidal, Coated Bioclastics Packstone and Grainstone, Well-D, 8392.7'. This microfacies is characterised by Platform Margin microfossils that include oyster bivalves and *Protopeneroplis* spp. and *P. Lituus.*

Plate 106



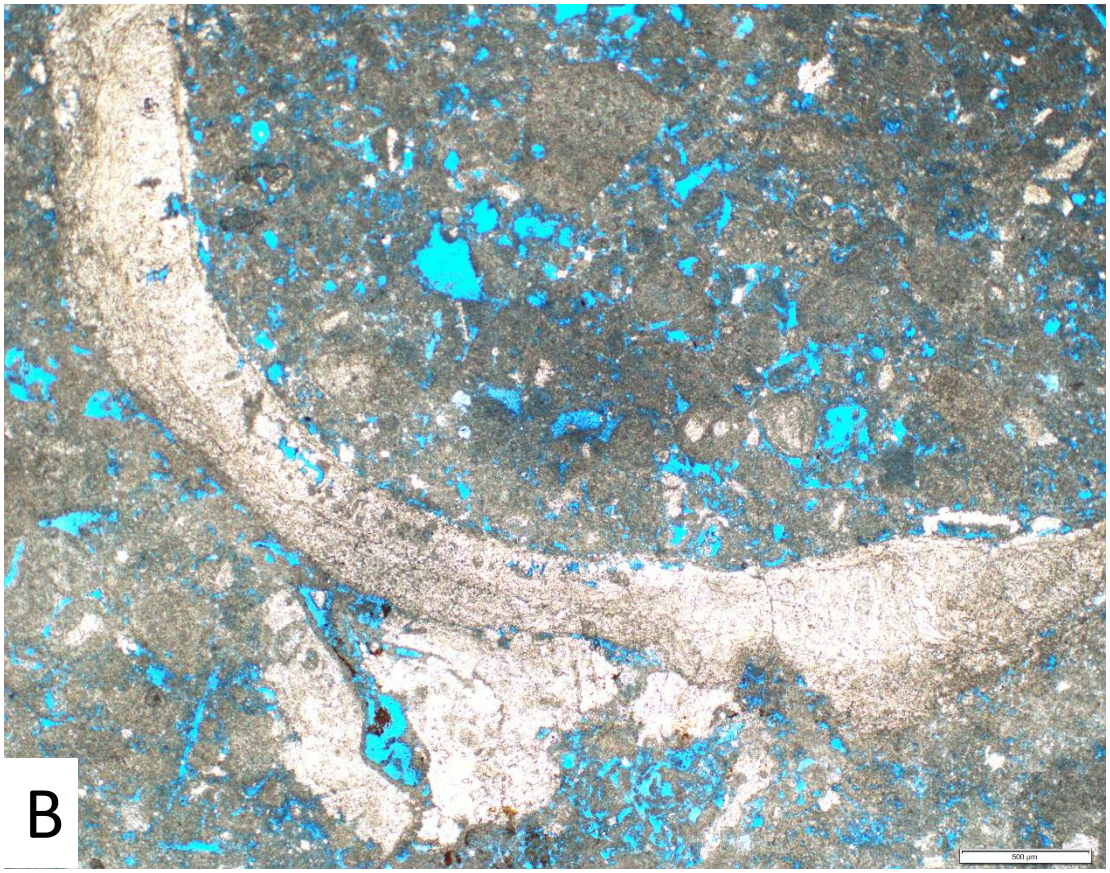
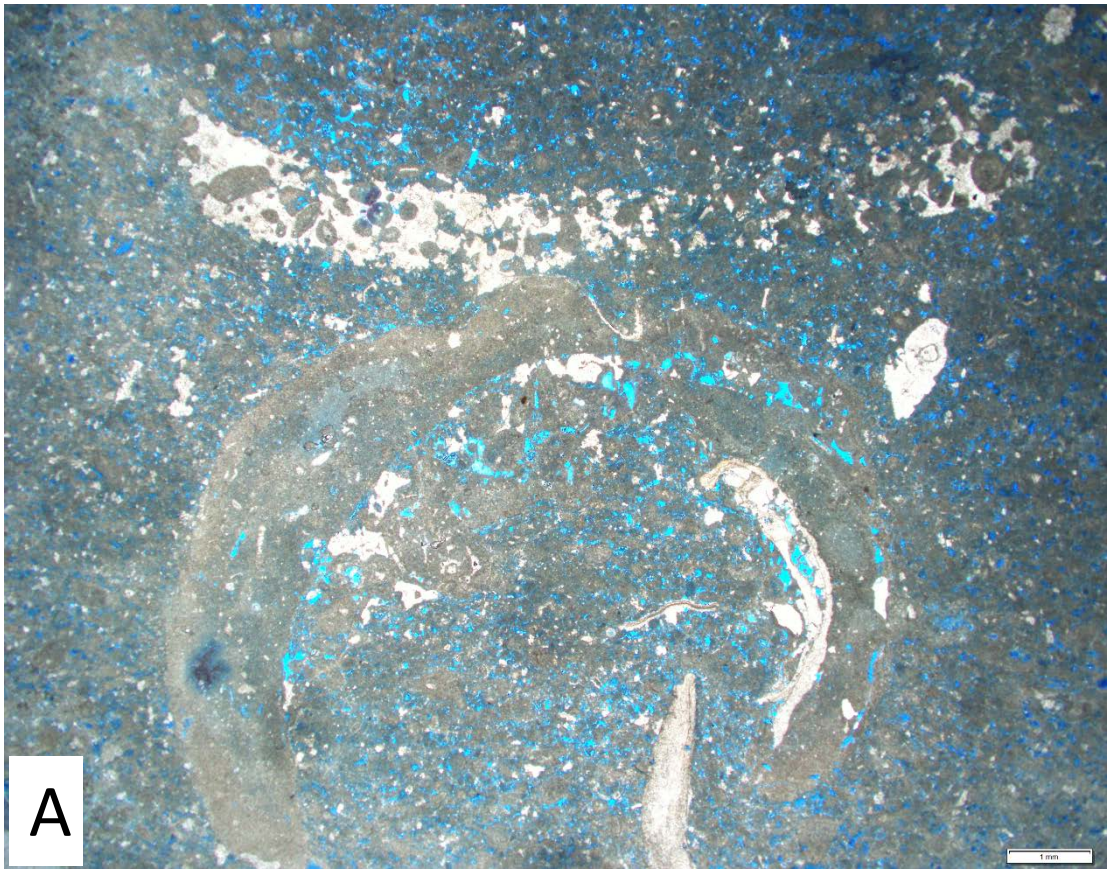


Plate 107

A. DMF 14: Peloidal, Coated Bioclastics Packstone and Grainstone, Well-D, 8392.7'. This microfacies is characterised by Platform Margin microfossils that include oyster bivalves and *Protopeneroplis* spp. and *P. Lituus.*

B. DMF 15: Lithocodium Boundstone, Well-D, 8385.2'. This microfacies texture is mainly that of boundstone to packstone. It is mainly composed of *Lithocodium aggregatum* large oncoids indicating categories 3 and 4 of Vědrine *et al*. (2007) and Michetiuc *et al*. (2012), in which they are characterized by encrusting microbial meshwork shapes. This microfacies has very good reservoir quality in which it contains moldic (MO) and intraparticle (IP) porosity above 15 %.

Plate 107



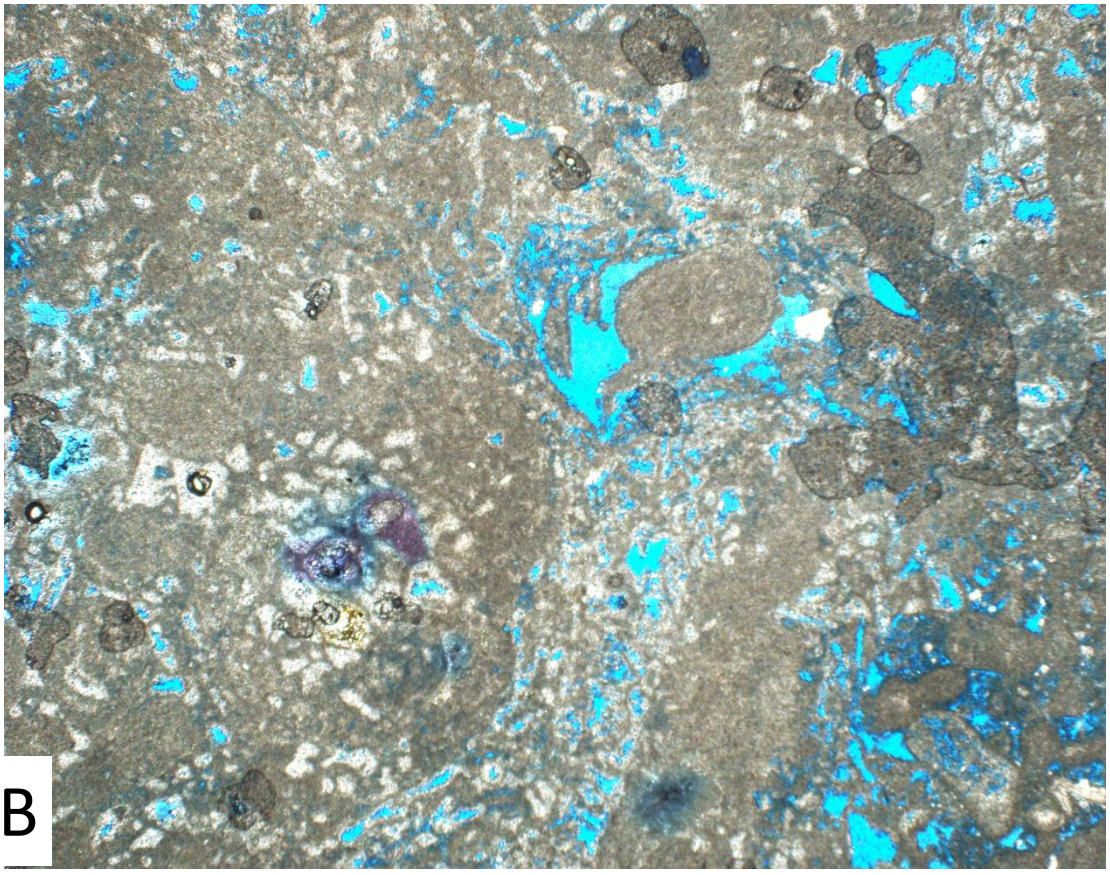
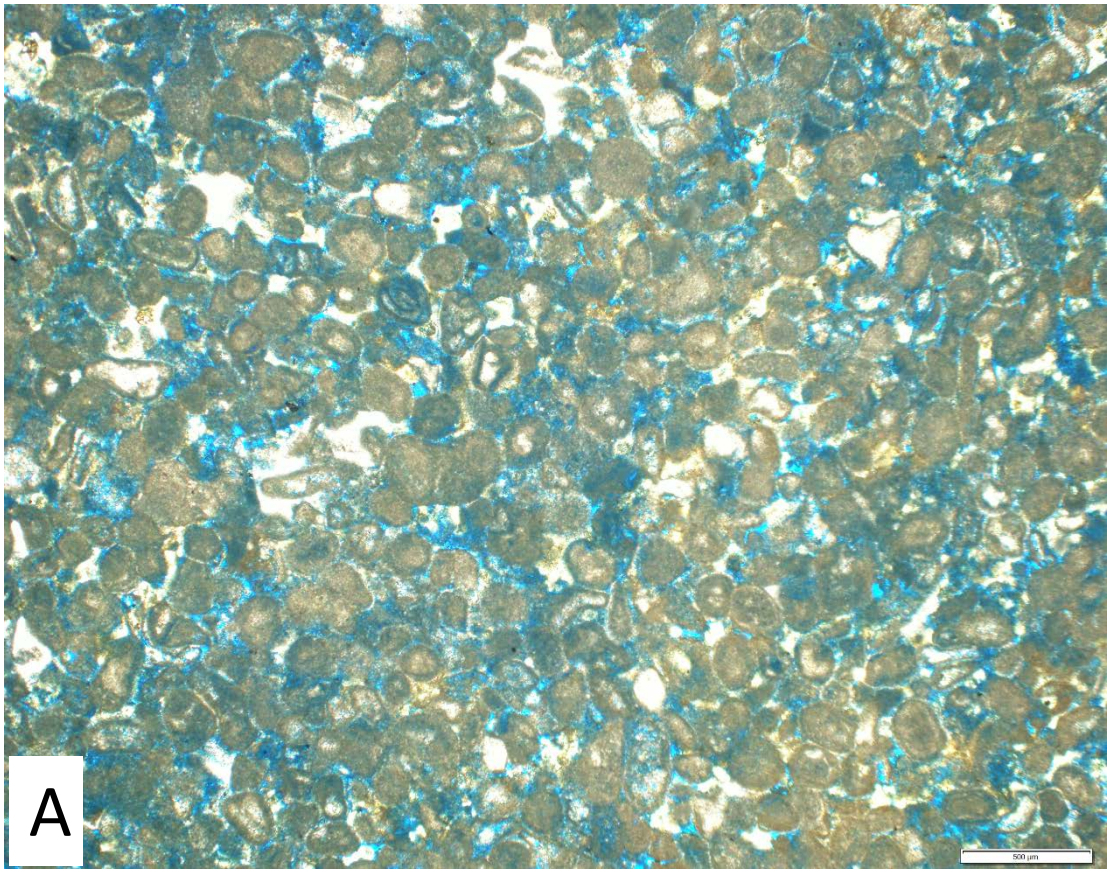


Plate 108

A. DMF 16: Non-Laminated Peloidal, Miliolids Grainstone, Well-D, 8320.7‘. This microfacies texture is mainly that of grainstone. The main matrix is clean fine, very well-sorted peloids that is abundant by syntaxial cement growth surrounding echinoderm plates. The very well sorted peloids have been created within the lagoonal floor. This microfacies has very good reservoir quality in which it contains interparticle (IP) porosity of up to 20 %. This microfacies is characterised by lagoonal microfossils that include abundant *Quinqueloculina* spp, rare *Textulariopsis jurassica* and echinoderm fragments with syntaxial cement overgrowth.

B. DMF 17: Peloidal Intraclastic Skeletal Grainstone , Well-D, 8295.7‘. This microfacies texture is mainly that of grainstone. The main matrix is of non-laminated, fairly sorted, intraclastic, peloidal, *Quinquloculina* grainstone. This microfacies is associated with reworked lithoclasts and coated skeletal fragments. These are very well-sorted peloids and minor to poorly sorted, sub-rounded lithoclasts. This microfacies has very good reservoir quality in which it contains moldic (MO) and interparticle (IP) porosity above 30%.

Plate 108



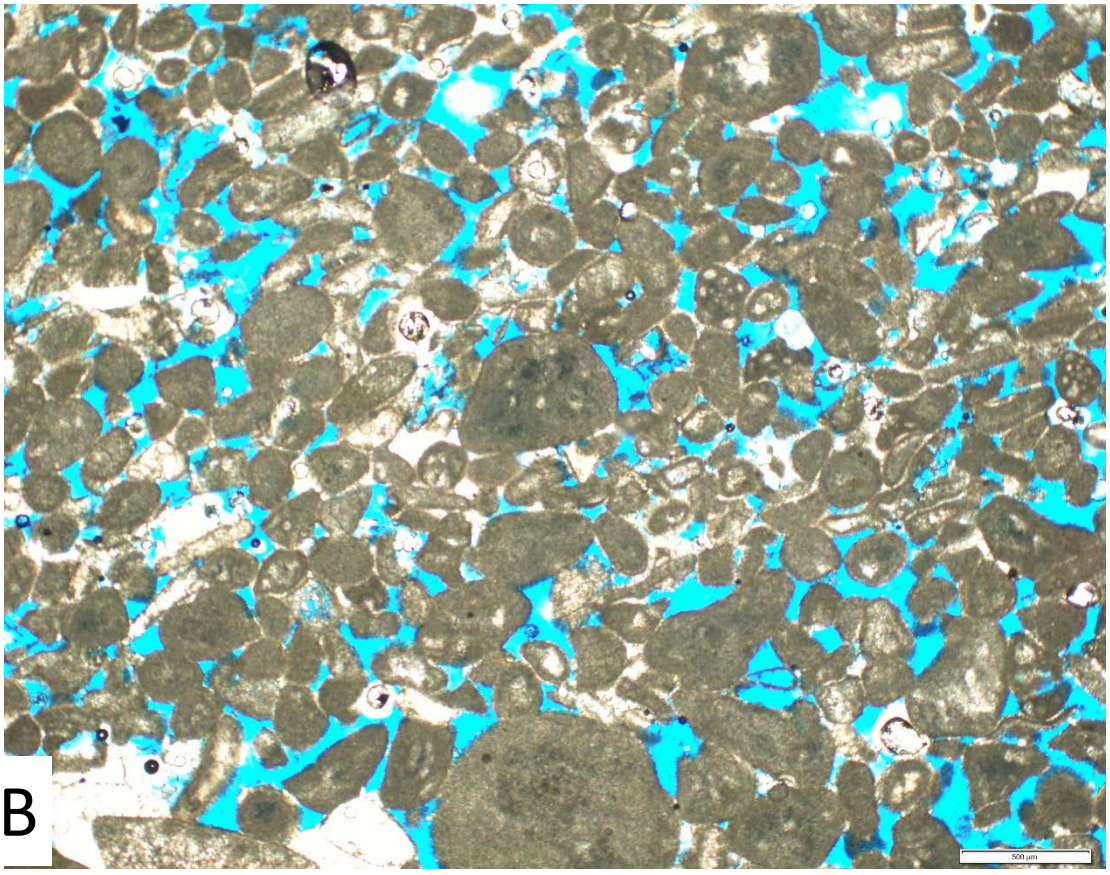
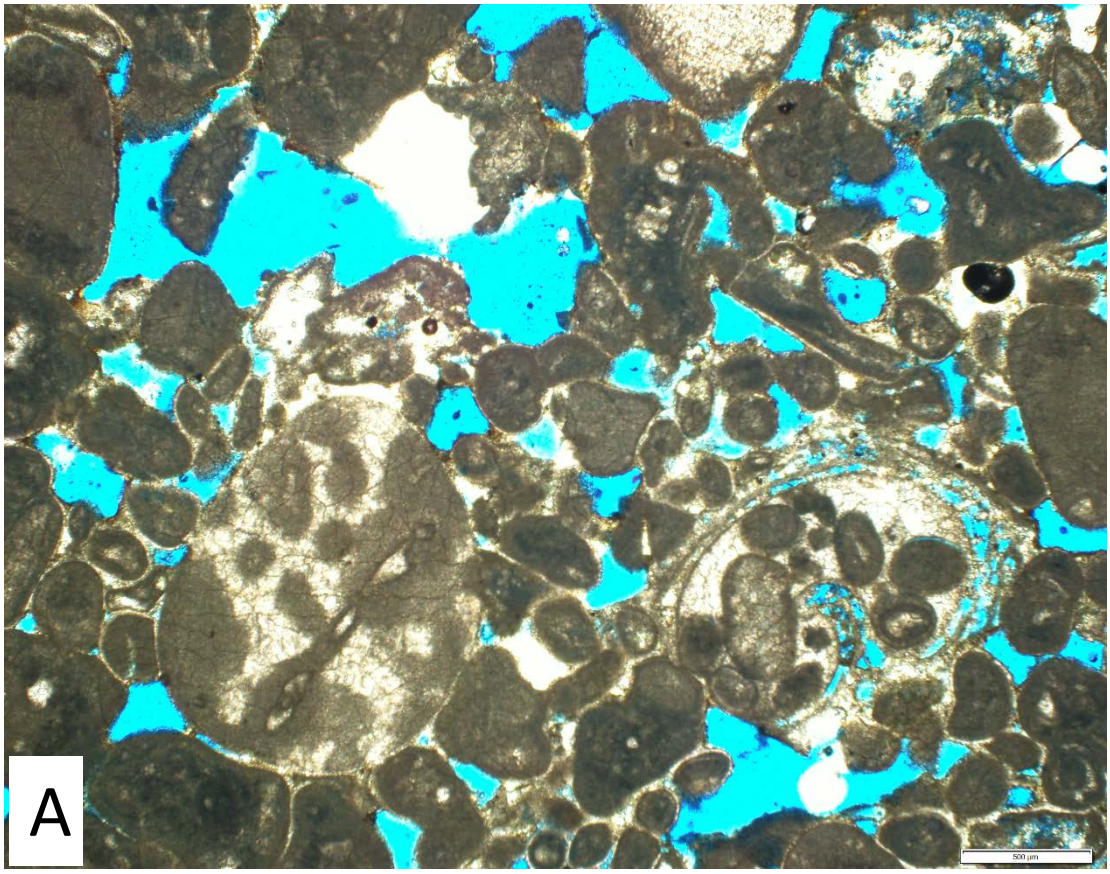


Plate 109

A. DMF 17: Peloidal Intraclastic Skeletal Grainstone , Well-D, 8295.7. Note the high porosity and the grain sorting.

B. DMF 18: Poorly sorted, Intraclastic Grainstone to Rudstone, Well-D, 8249.7‘. This microfacies texture is mainly that of sparry calcite cemented rudstone and grainstone. The main matrix is leached out, poorly sorted, intraclastic peloids and coated reef skeletal fragments (such as *Macroporella praturloni*, encrusting type of *Lithocodium aggregatum* and oyster bivalves) by micritic envelopes. This microfacies has poor reservoir quality in which it contains a moldic (MO) porosity ~ 3 %.

Plate 109



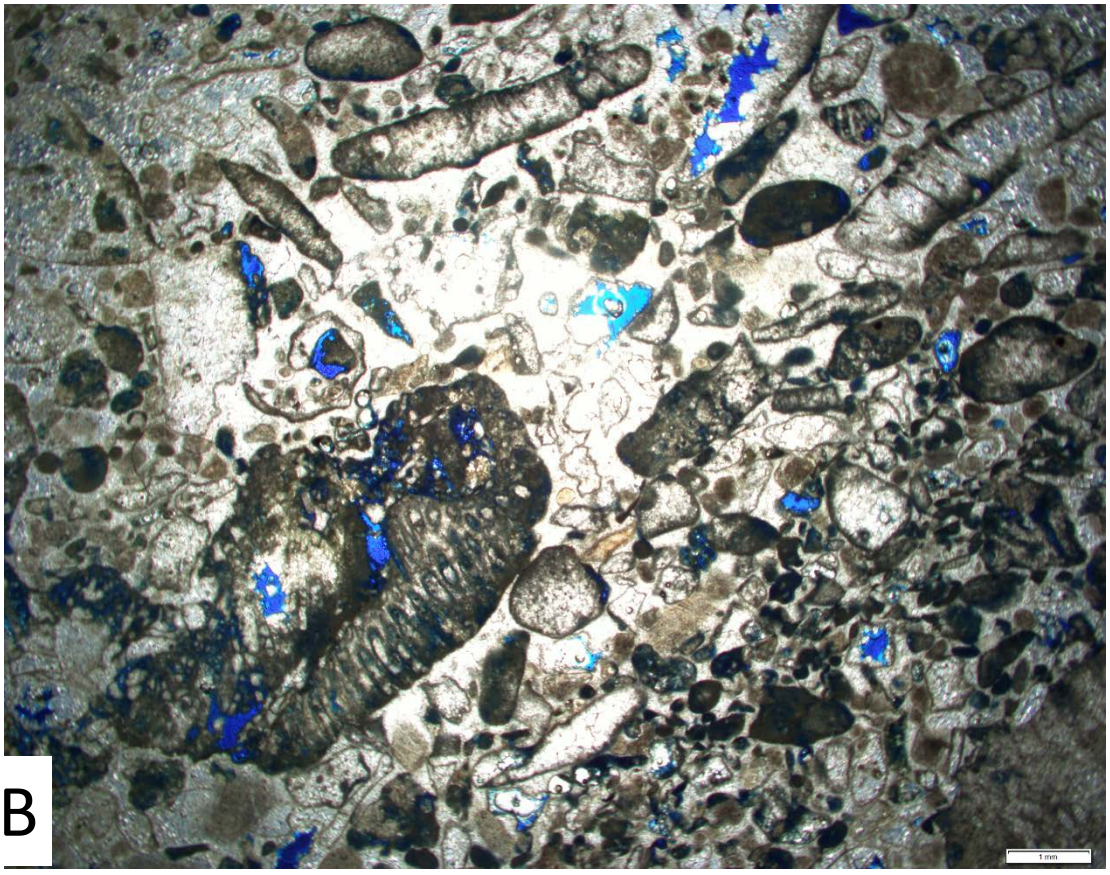
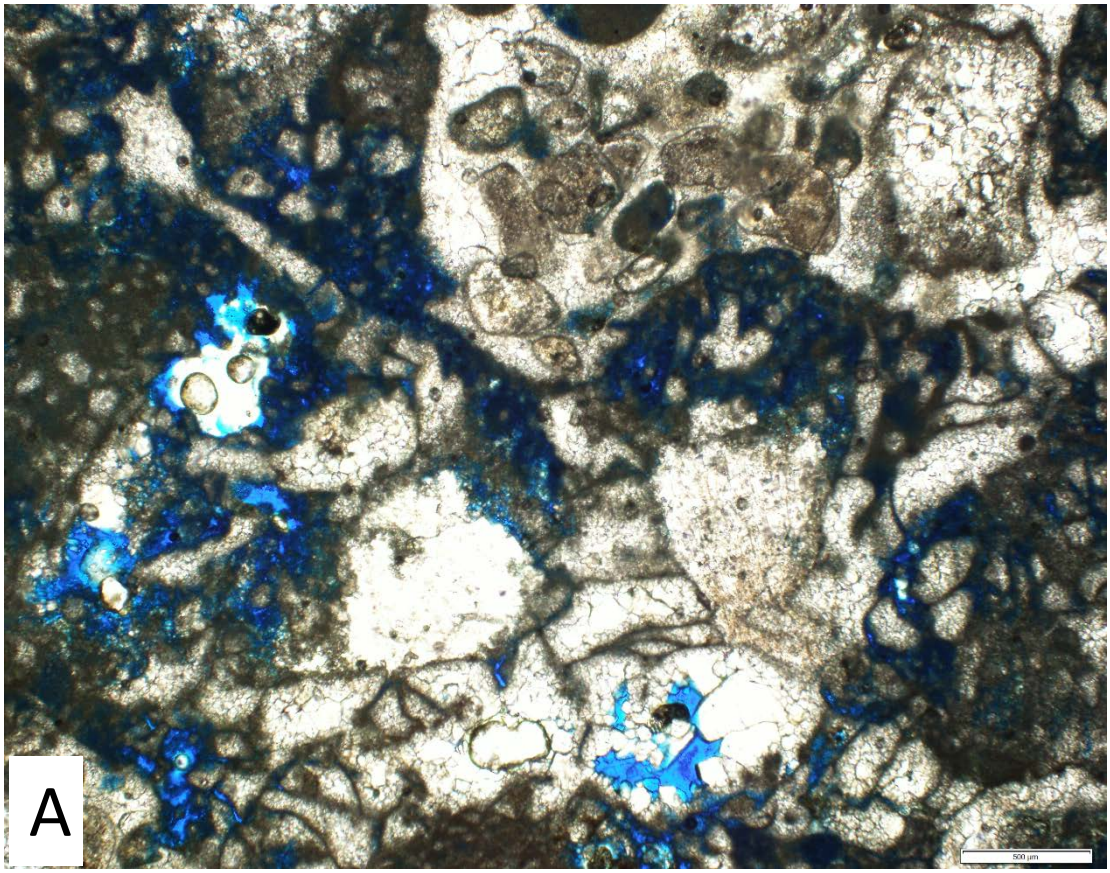


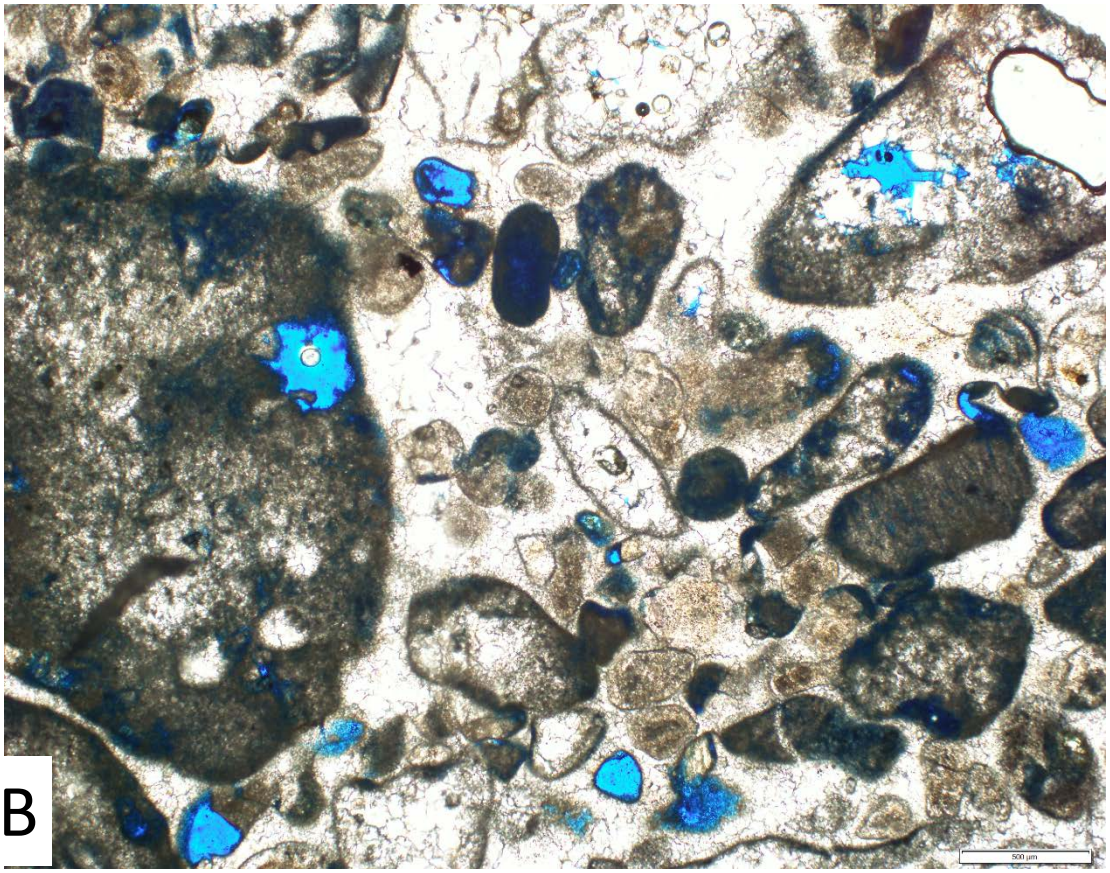
Plate 110

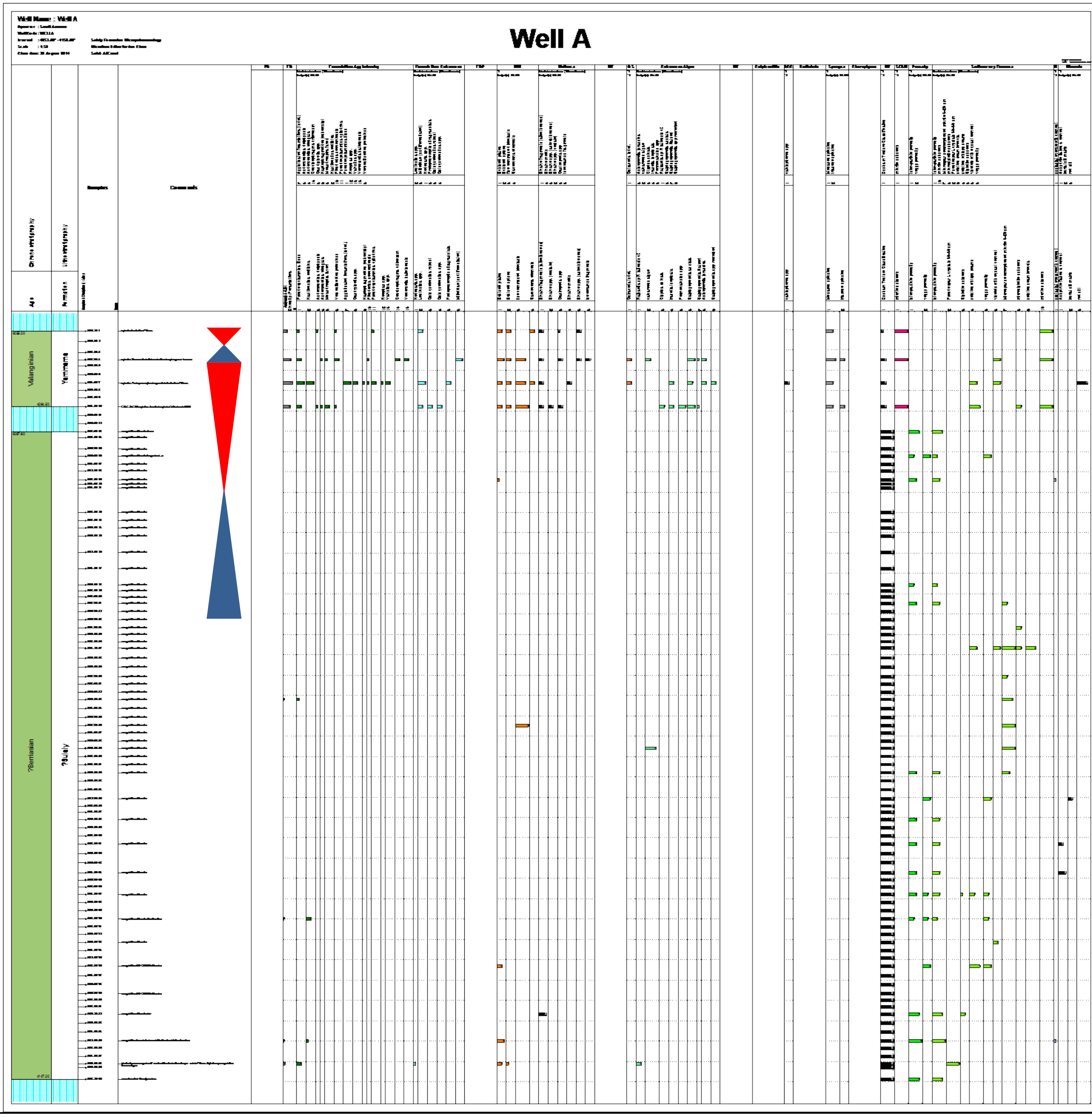
A. DMF 18: Poorly sorted, Intraclastic Grainstone to Rudstone, Well-D, 8249.7. This microfacies is characterised by platform margin microfossils *Macroporella praturloni*, encrusting type of *Lithocodium aggregatum* and the oyster bivalves.

B. DMF 18: Poorly sorted, Intraclastic Grainstone to Rudstone, Well-D, 8249.7. This microfacies is characterised by platform margin microfossils such as *Mohlerina basiliensis.*

Plate 110



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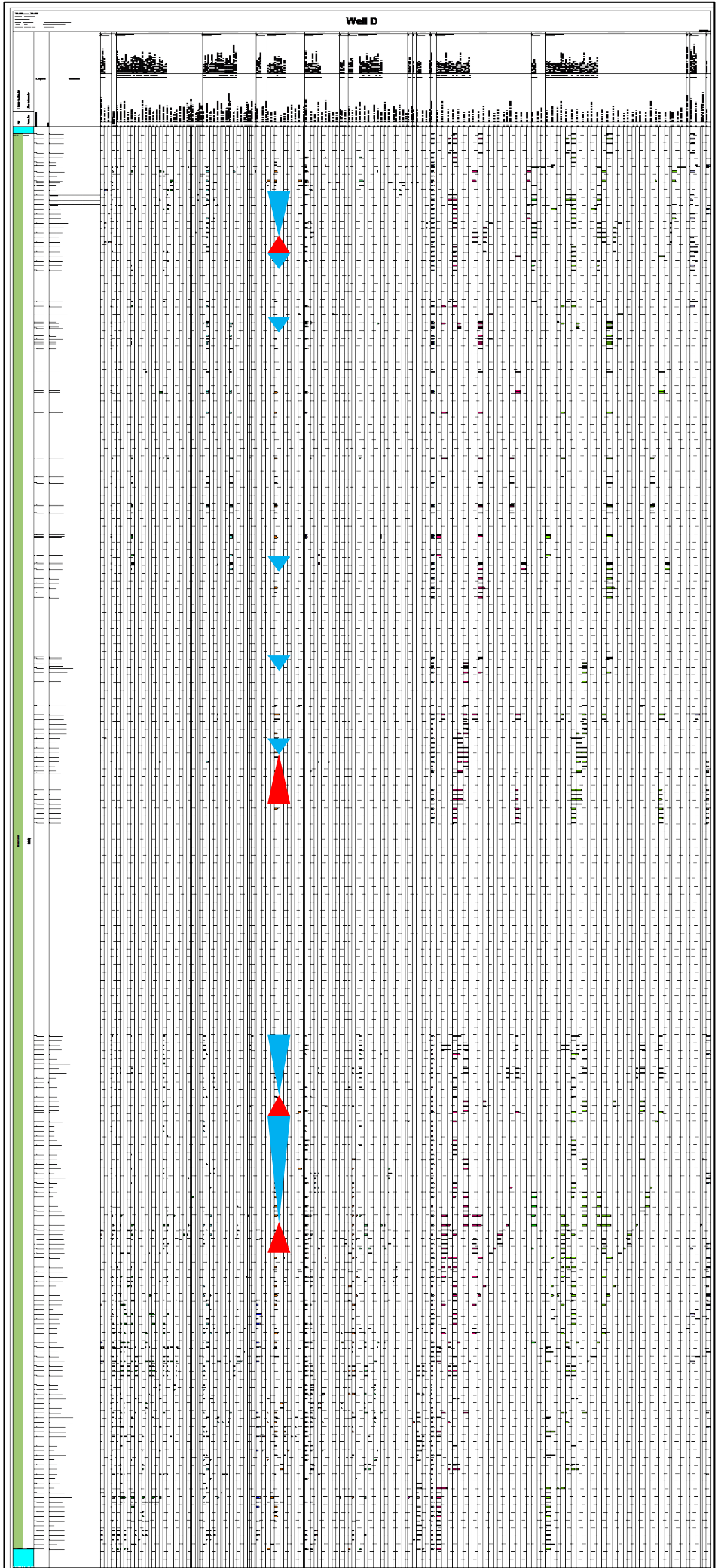
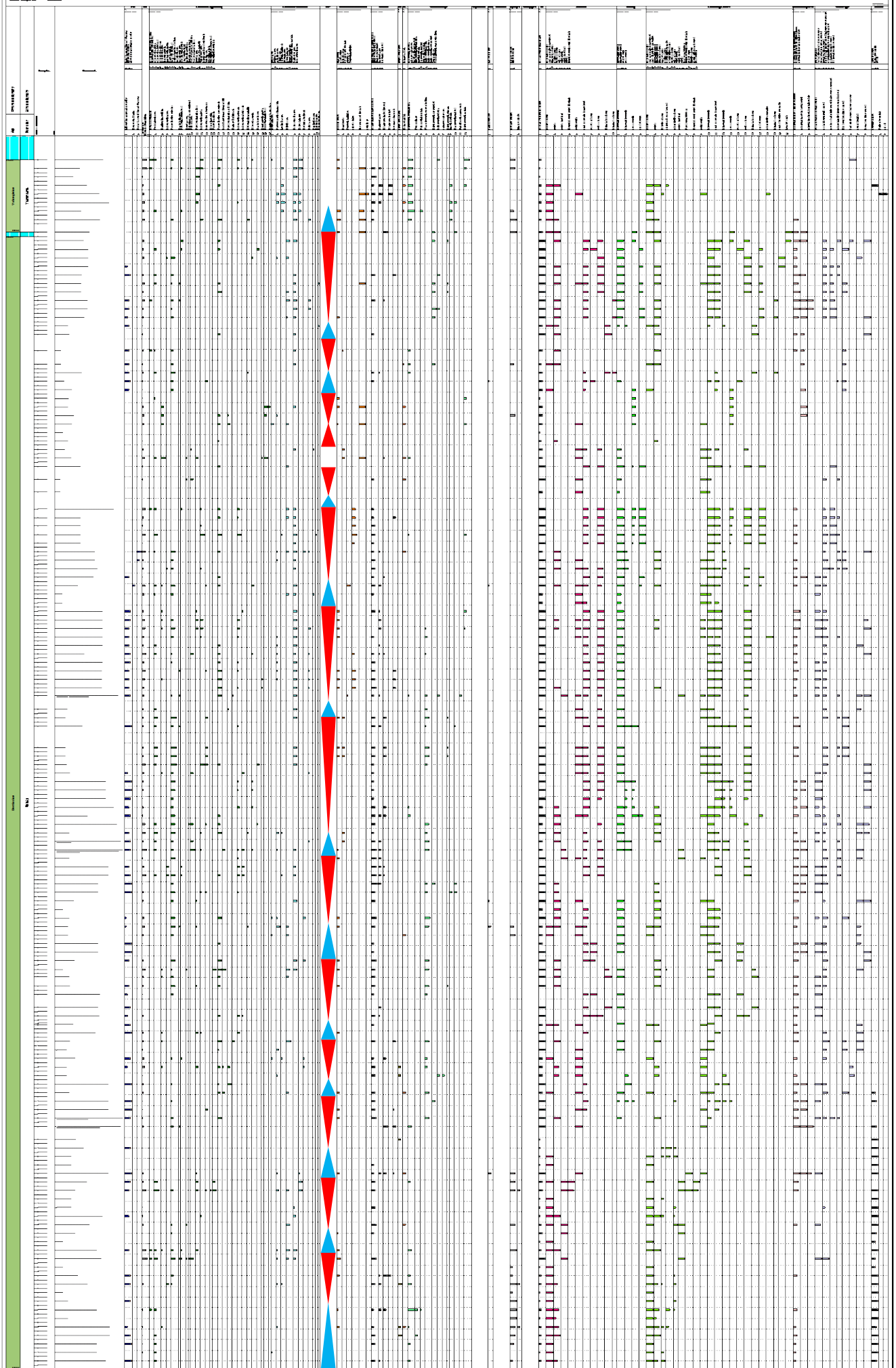
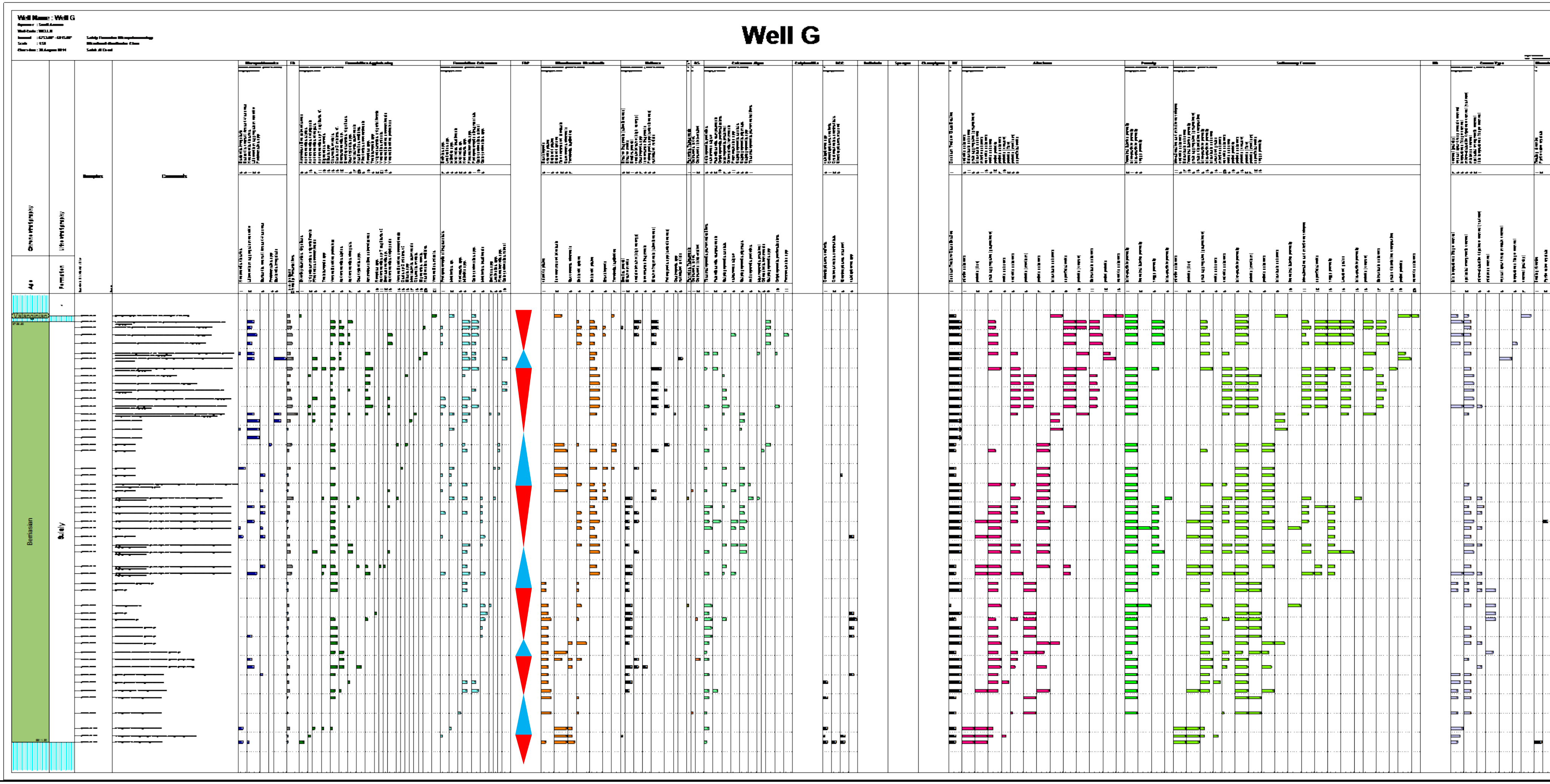
Well B


Well D

Well F

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Well Name : Well H

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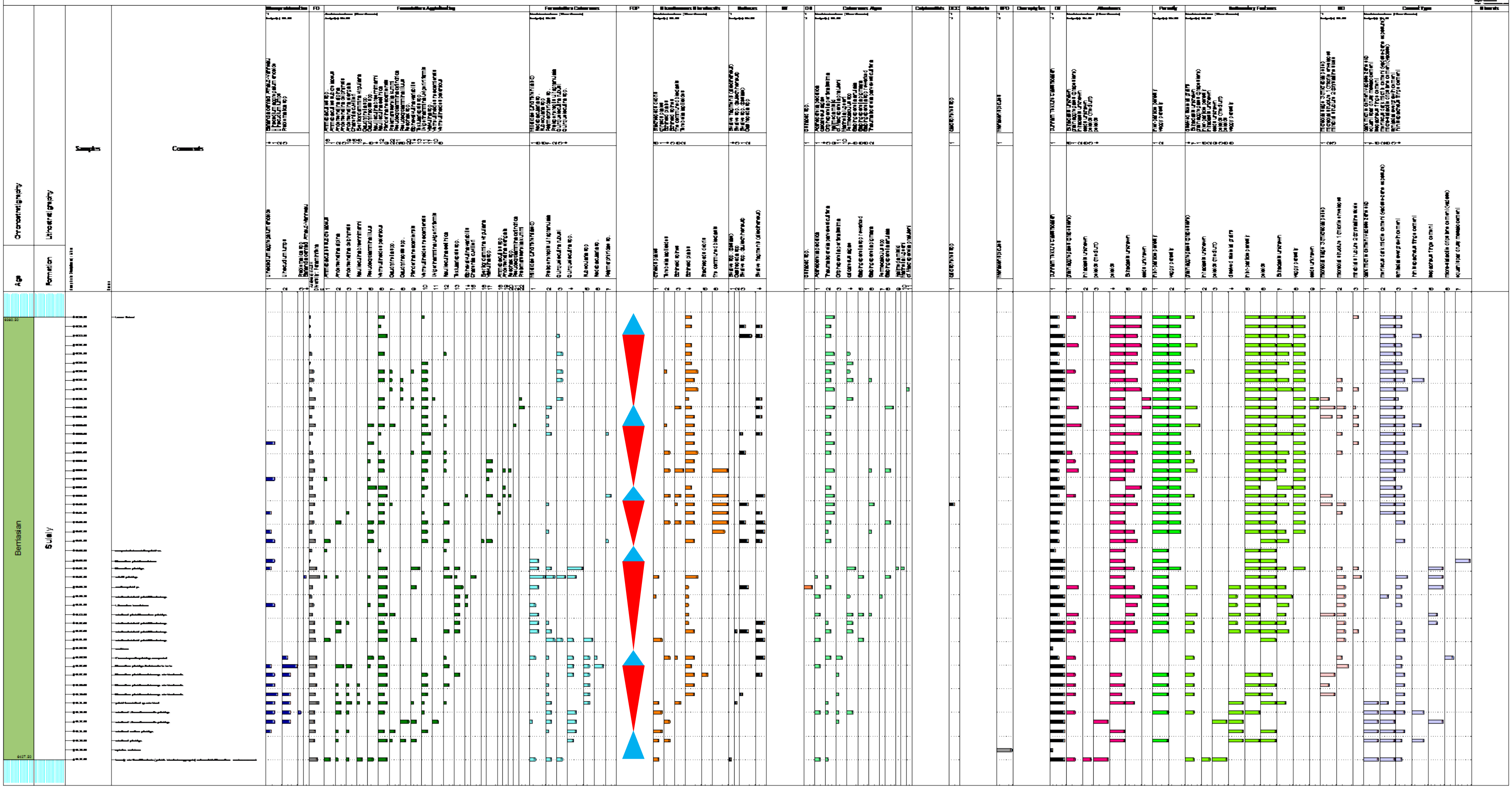

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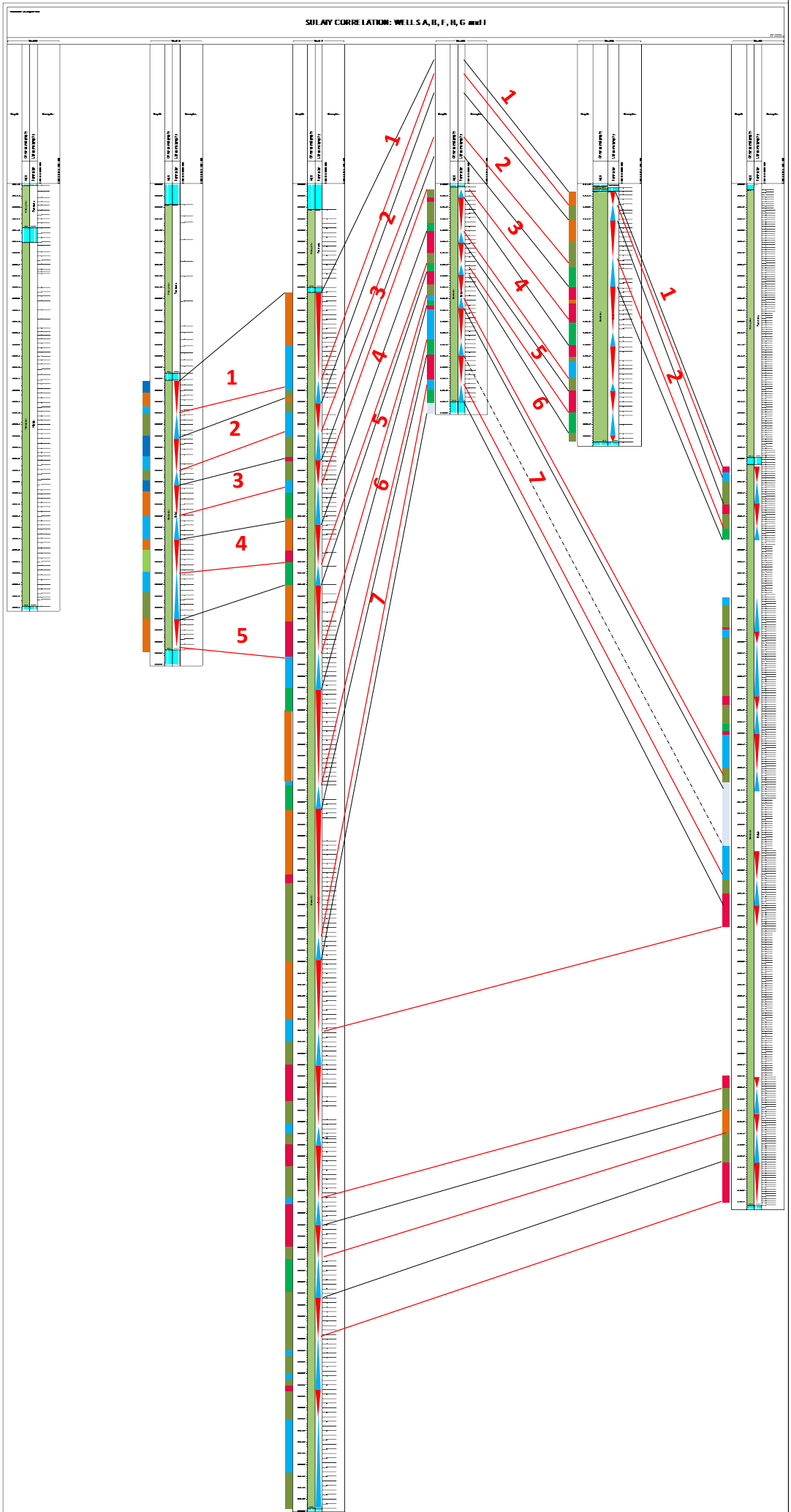
SULAIY CORRELATION: WELLS A, B, F, H, G and I
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