

Photo 1: Matrix of micrite/ carbonaceous mud with high percentage of siliciclastic sand and silt. Shrinkage fractures partially filled with microcrystalline carbonate cement. Other small voids contain thin film of meniscus cement. Crossed polars.

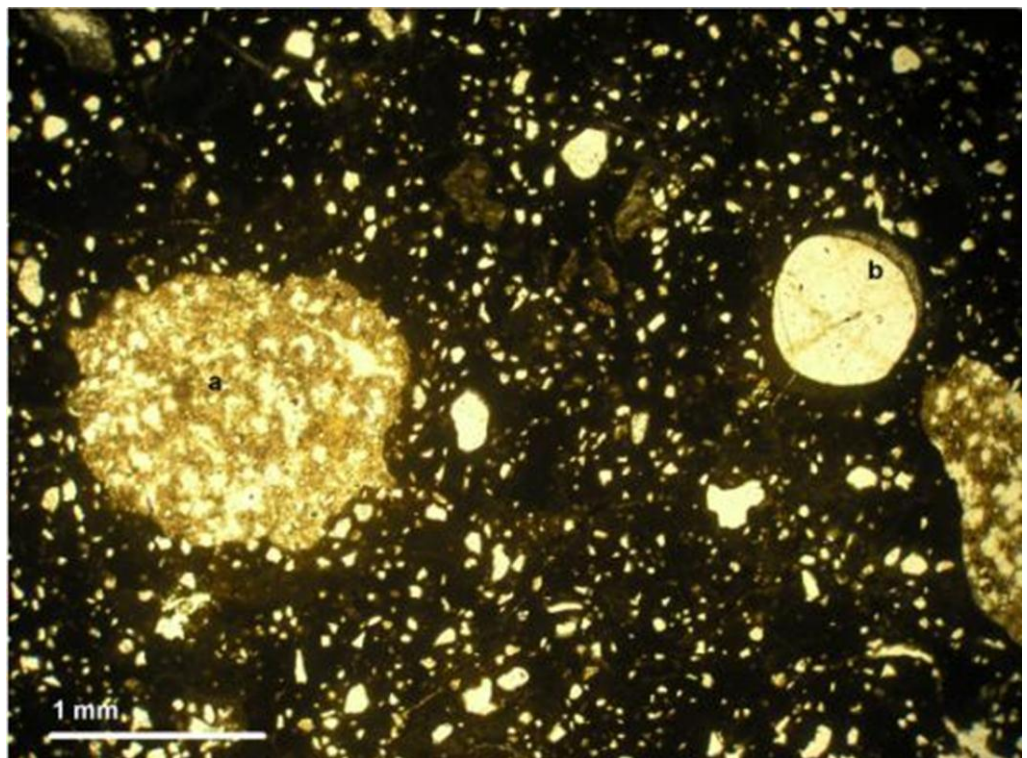


Photo 2: Large carbonaceous clast (a) containing small unfilled primary voids within carbonaceous mud matrix. Large rounded quartz grain has "cap" (Dripstone cement) of micritic geopetal meniscus cement (b). Plane light.



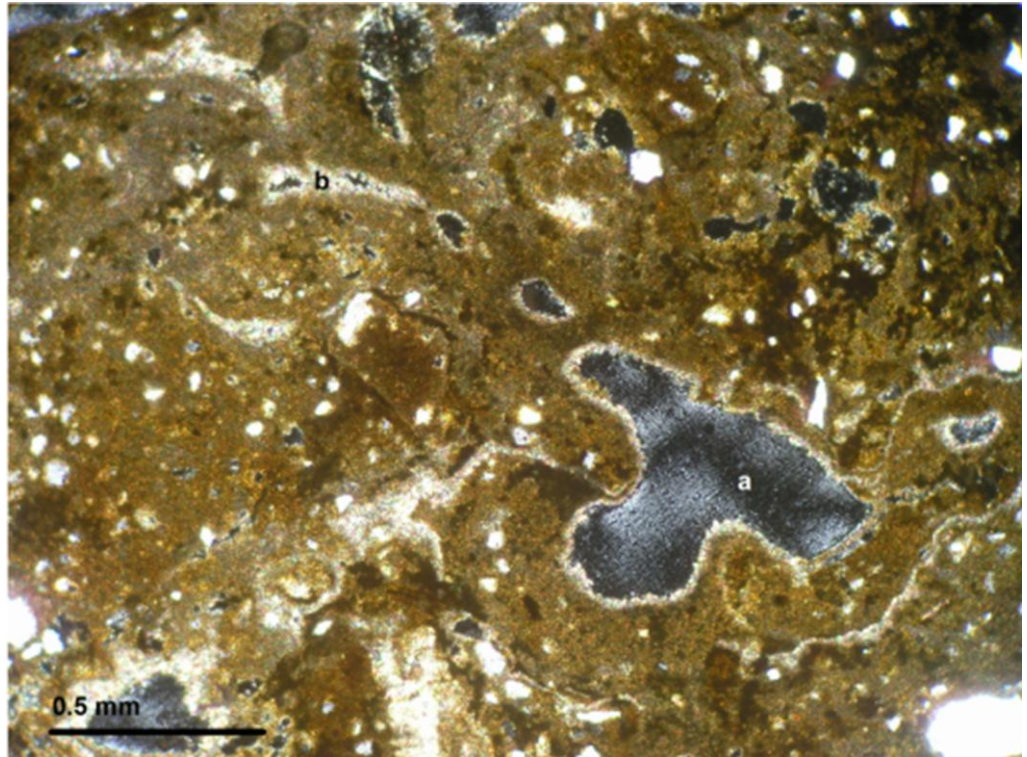


Photo 3: Unusually shaped void (a) with thin layer of micritic cement. Shrinkage fractures (b) and other small rounded voids filled with geopetal micritic or microcrystalline cement. Crossed polars.

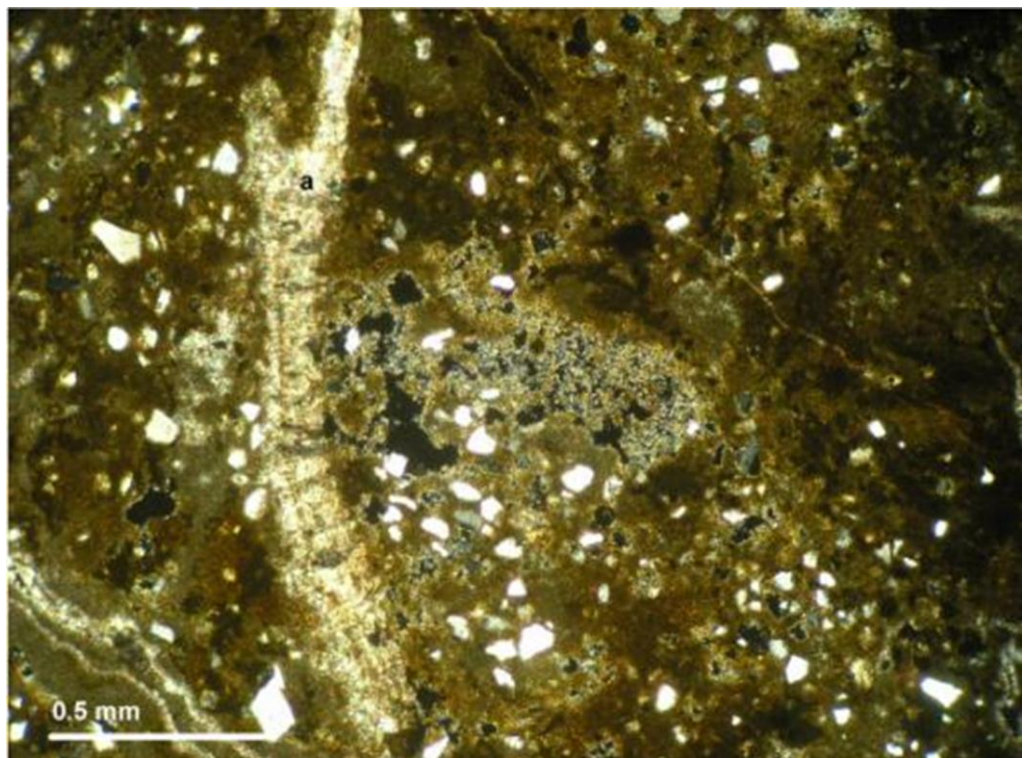


Photo 4: Fracture filled with laminated bladed carbonate cement (a). Carbonaceous mud matrix appears "blotchy" with possible dendritic deposits of goethite. Crossed polars.

**Sample No** WSRS005

**Location**

662388E, 6760524N (GDA94 Z53)

**Texture**

Fine grained oncoidal limestone. Clotted micritic matrix.

**Carbonate Grains**

30% oncoids, 5% peloids, 5% bioclasts (gastropods, ostracods, cyanoliths).

**Siliciclastic Grains**

4% quartz silt and sand.

**Voids**

0.5% intra-particle (bioclasts), 0.5 % fenestra.

**Carbonate Mud**

50%

**Cements**

3% microcrystalline, 2% micritic, 1%, granular.

**Other**

Tr. zircon, tr. goethite.

**Comments**

-

**Classification**

Oncoidal wackestone.

**Interpretation**

Shallow tail or channel environment.



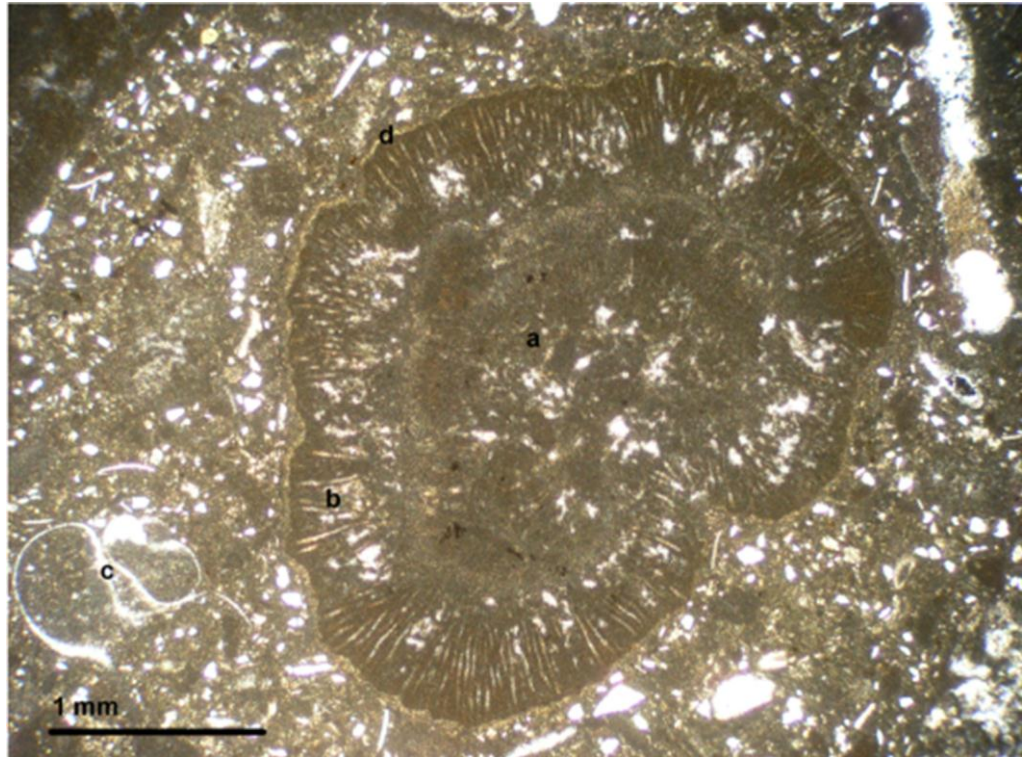


Photo 1: Porostromate oncoid (a) in matrix of carbonaceous mud and siliciclastic particles. Fenestra in oncoid filled with microcrystalline carbonate cement (b). Gastropod bioclasts (c) are evident within lower left corner of image. Oncoid has thin layer of micritic cement (d). Plane light.

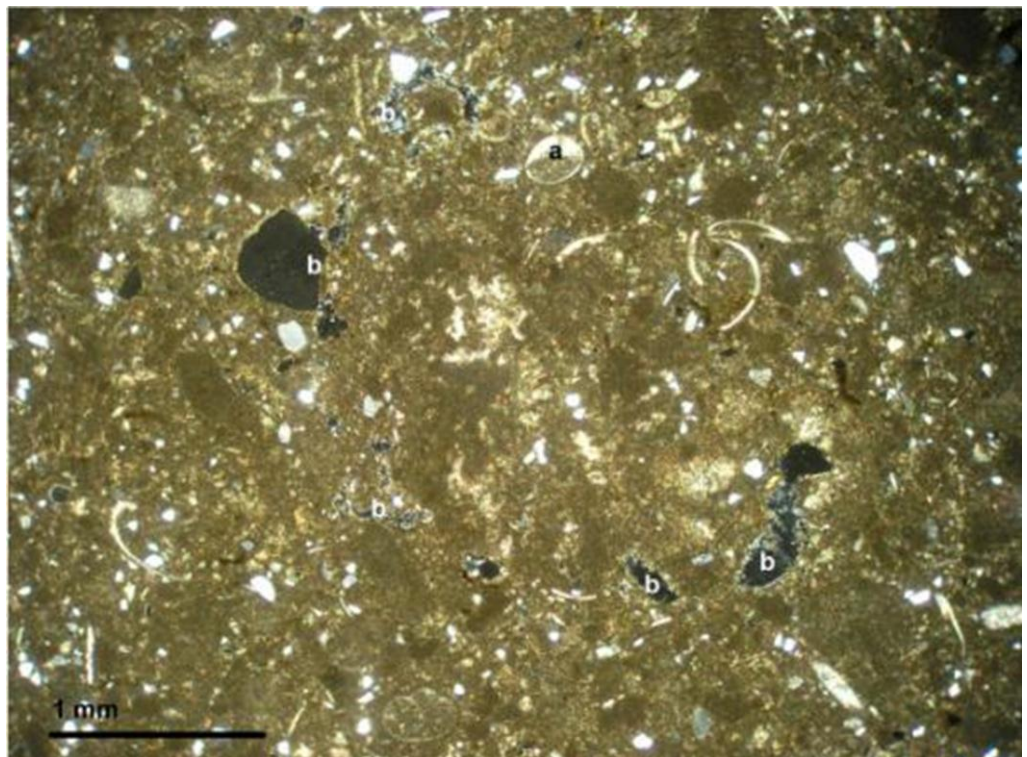


Photo 2: Sample matrix composed of "clotted" carbonaceous muds. Ostracod fossils (a) prevalent in sample; ostracod fossil near top of image has geopetal infill of granular carbonaceous cement and matrix material (a). Unfilled voids (b) (fenestra?) form circular pattern. Crossed polars.



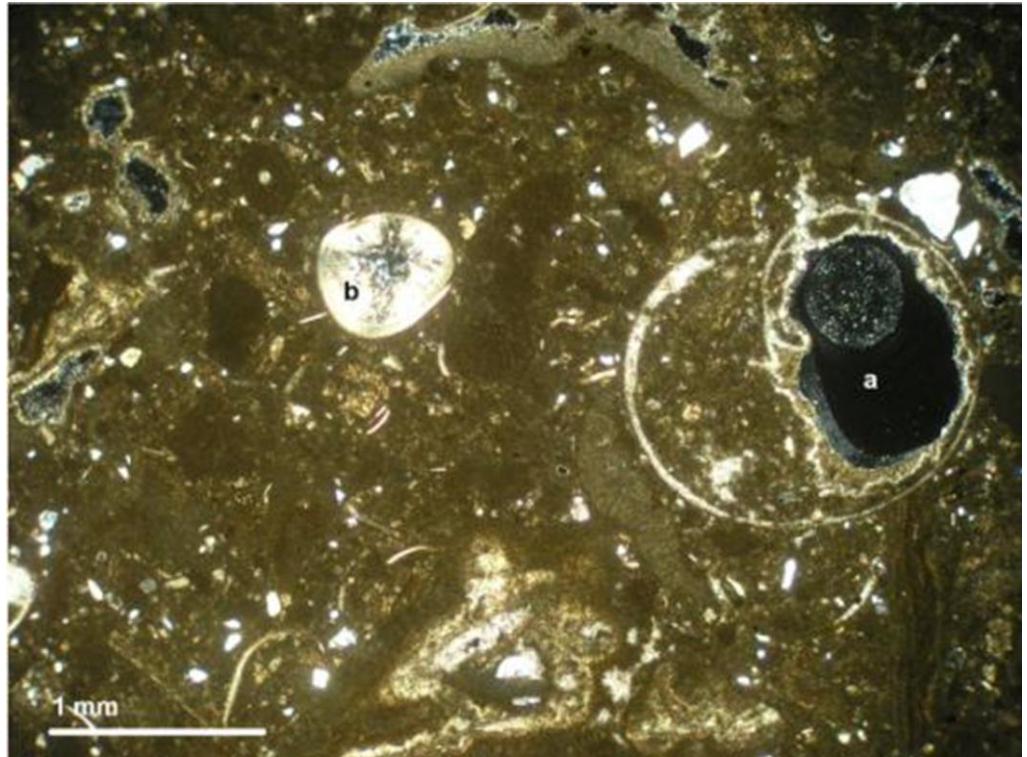


Photo 3: Gastropod (a) and ostracod (b) fossils. Ostracod filled with radiaxial fibrous cement; gastropod partially filled with matrix material. Geopetal micritic cement evident top of image. Crossed polars.

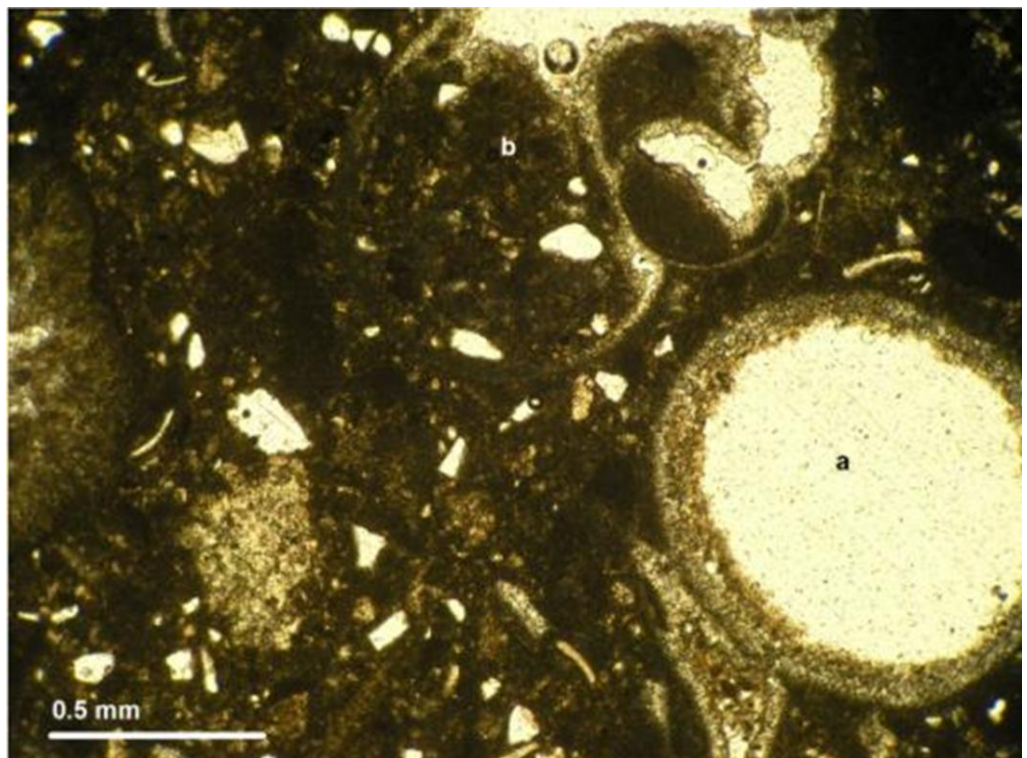


Photo 4: Charophyte (a) and gastropod (b) fossils partially filled with micritic and microcrystalline carbonate cement. Plane light.

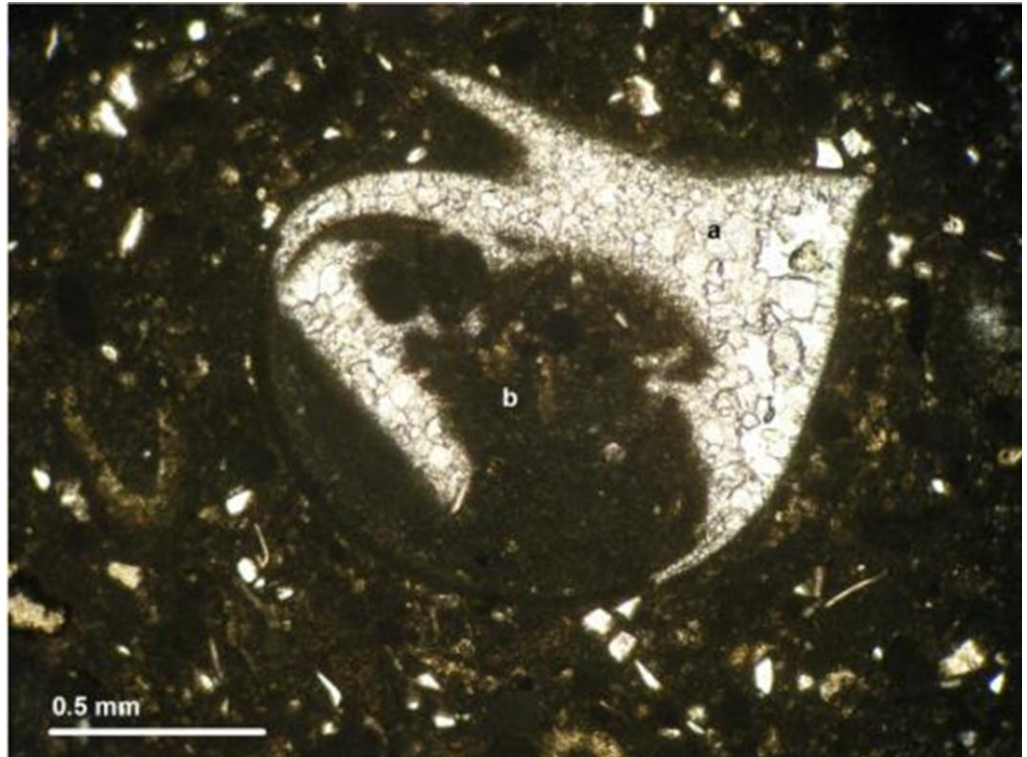


Photo 5: Gastropod fossil filled with geopetal granular (Drusy?) carbonate cement (a), followed by matrix material (b). Plane light.

**Sample No** WSR007

**Location**

662414E, 6760395N (GDA94, Zone 53)

**Texture**

Light grey vuggy limestone with abundant cavities (probably reed castings) Sand and fossils in matrix. Crumbles to fine sand texture. Clotted and renalcid micritic matrix.

**Carbonate Grains**

30% peloids, 10% lumps and rounded clasts, 1% oncoids, 1% bioclasts (ostracods, charophytes)

**Siliciclastic Grains**

30% quartz sand, tr. plagioclase

**Voids**

20% fenestral (10% filled, 5% unfilled 5% partially filled), tr. charophyte partially filled with micrite/ sand.

**Carbonate Mud**

24%

**Cements**

5% micritic, 5% microcrystalline, 2% granular /bladed.

**Other**

1% goethite staining deposited as rim near edge of sample, 1% dendritic manganese oxide.

**Comments**

Lumps and clastic grains show rework. Granular cementation lines some voids that are later filled with micrite and sand matrix. Thin linings of microcrystalline cement shows potential for periods of sub-aerial exposure.

**Classification**

Fenestral packstone.

**Interpretation**

Channel or vegetated swamp deposit at a distance from vent.



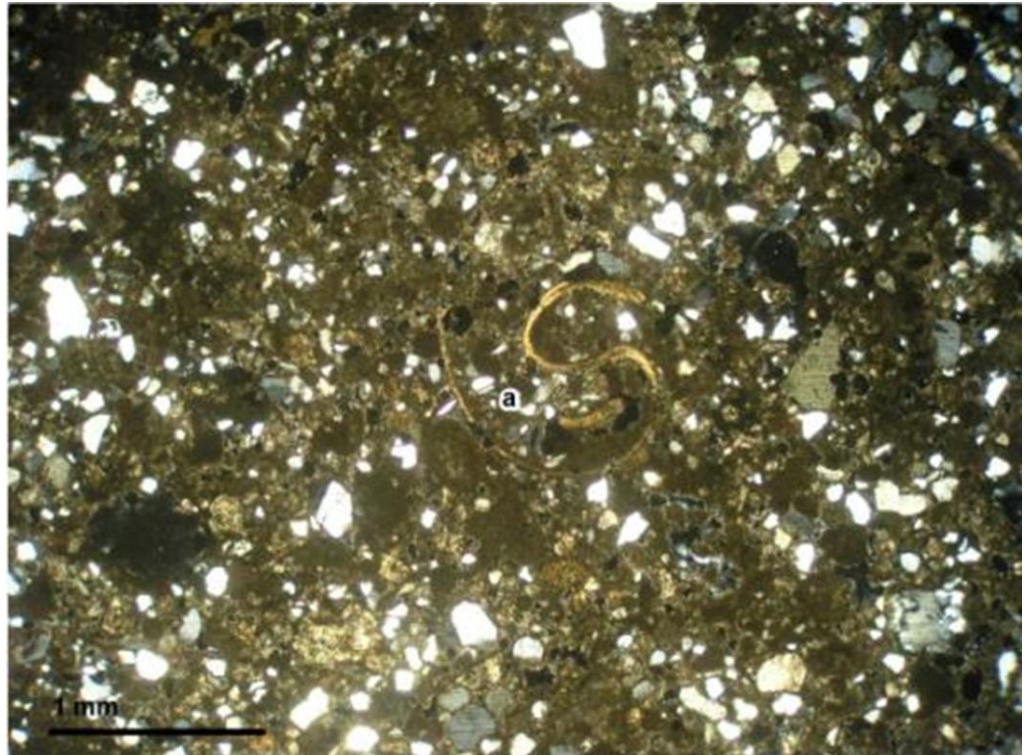


Photo 1: Peloidal carbonate matrix with a high proportion of siliciclastic material. Gastropod bioclast located in the centre of the image (a). Crossed polars.

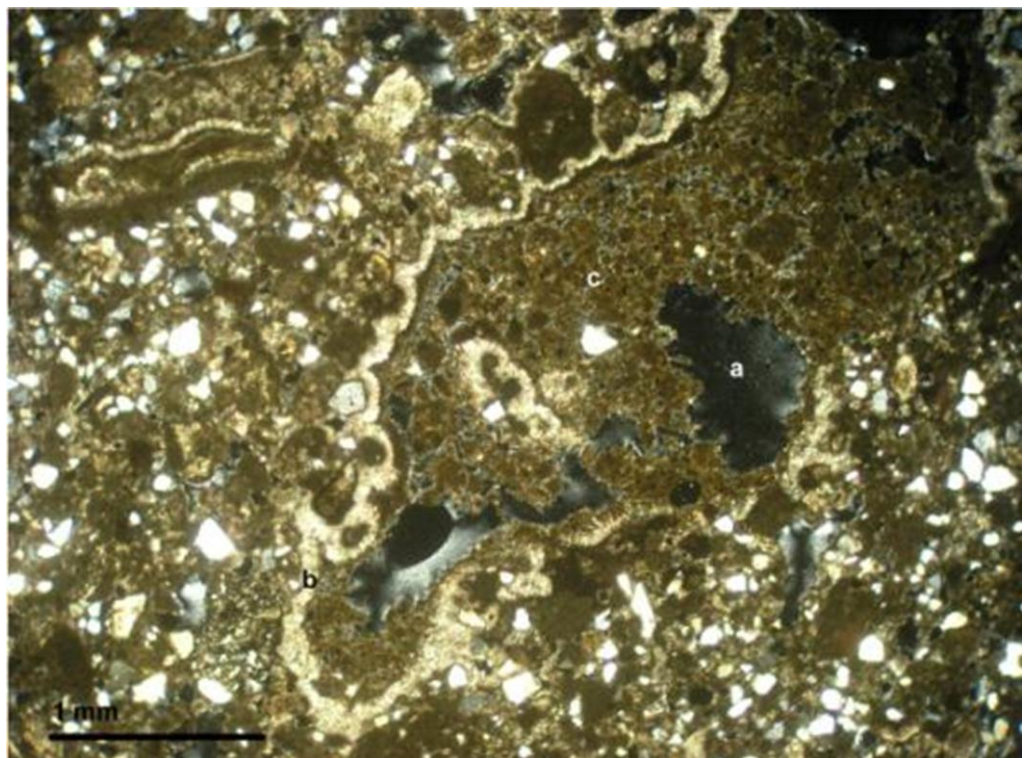


Photo 2: Large fenestral (?) void (a) lined with geopetal microcrystalline cement (b) and then filled with peloidal carbonate material(c). Some inter-particle microcrystalline carbonate cement present in peloidal infill. Unfilled voids interpreted to be primary. Meniscus cement also present between particles in matrix outside void. Crossed polars.



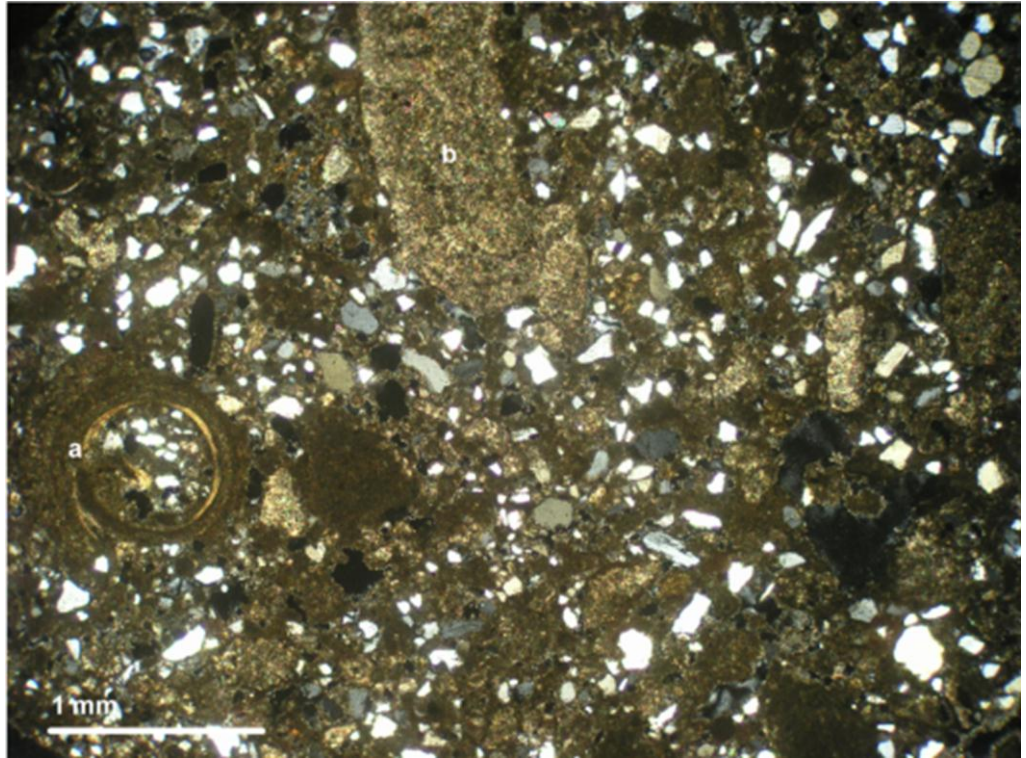


Photo 3: Charophyte fossil (a) in-filled with matrix material to left of image. Micritic cement void fill (b) evident top of image. Crossed polars.

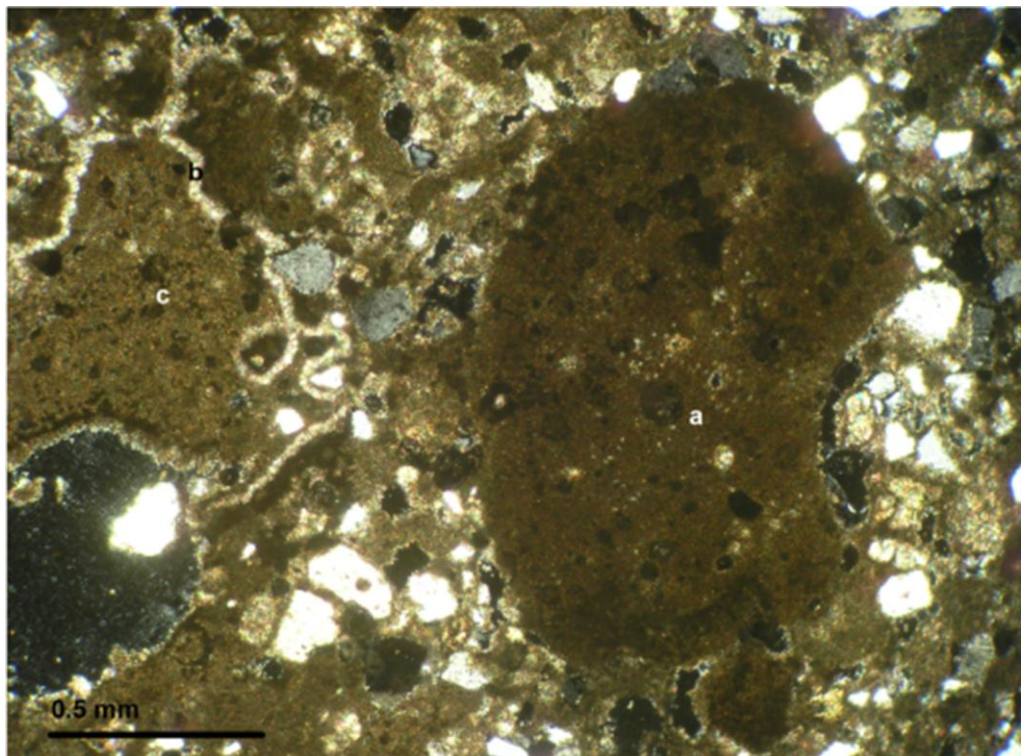


Photo 4: Carbonate clast or lump (a) within clotted carbonaceous mud and micrite matrix. Meniscus cement is evident between the smaller particles. Void at left of image lines with thin layer of microcrystalline carbonate cement (b) before being partially filled with micrite (c). Crossed polars.

**Sample No** WSRS010

**Location**

662288E, 6760392N (GDA94, Zone 53)

**Texture**

Micritic matrix with shrub texture evident perpendicular to casting plant castings. Modern phytohermal tufa.

**Carbonate Grains**

1% bioclasts, 25% peloids.

**Siliciclastic Grains**

Tr. quartz silt, tr. zircon.

**Voids**

25% fenestral, 5% inter-granular. 30% unfilled (very thin layer of meniscus cement evident)

**Carbonate Mud**

43%

**Cements**

1% meniscus.

**Other**

-

**Comments**

Rock has simple history and appears quite young. Micrite and micritic peloids compose bulk of material. Peloidal and shrub textures indicate role of microbes in controlling deposition of carbonate. Fenestral voids largely to do with root and reed casting, as well as microbial activity. Little cementation has been precipitated bar a little meniscus cement.

**Classification**

Fenestral mudstone.

**Interpretation**

Modern phytohermal tufa. Modern tail environment.



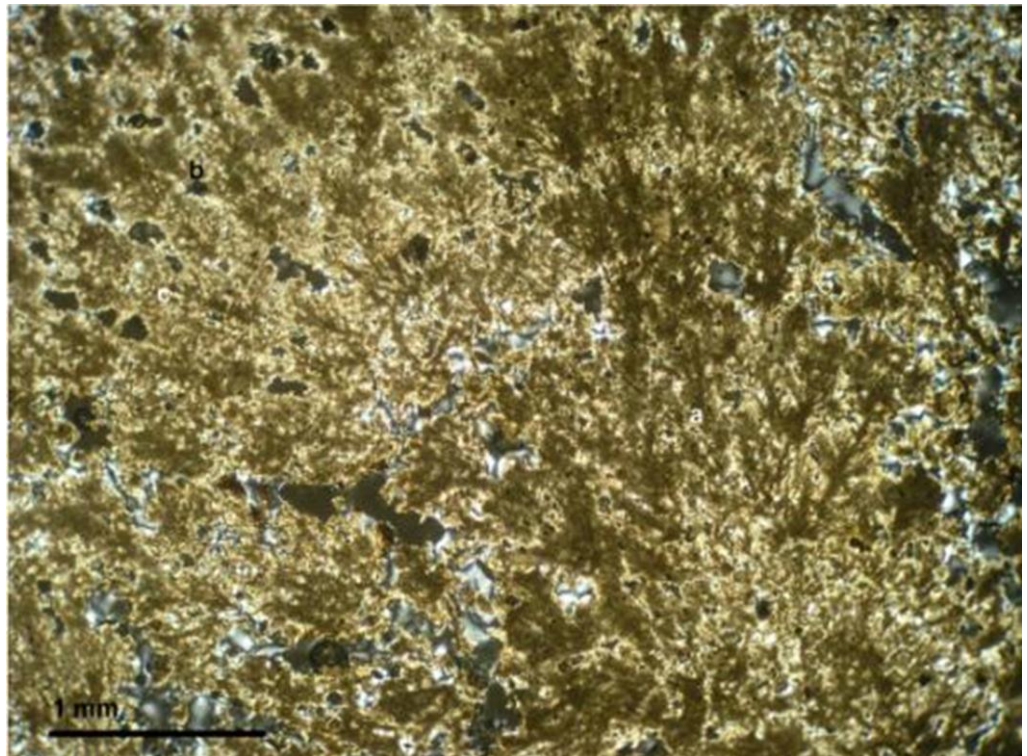


Photo 1: Microbially induced shrub textures in micritic matrix. Crossed polars.

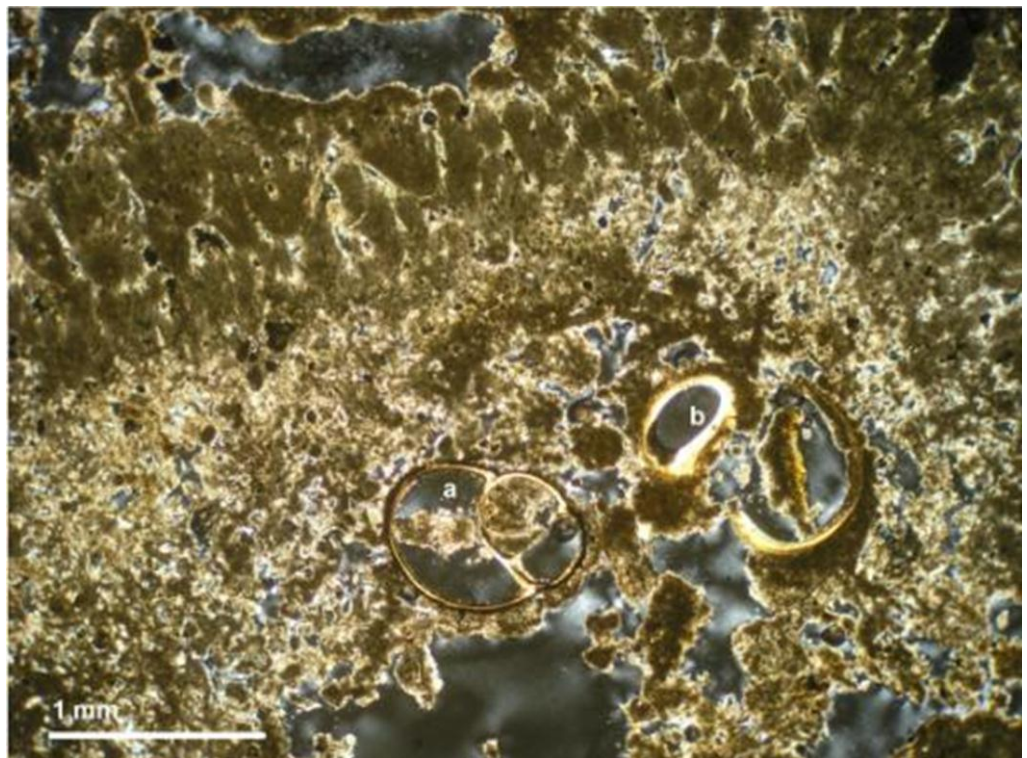


Photo 2: Mollusc (a) and ostracod (b) bioclasts in peloidal micrite matrix. Shrub textures near top of image. Crossed polars.



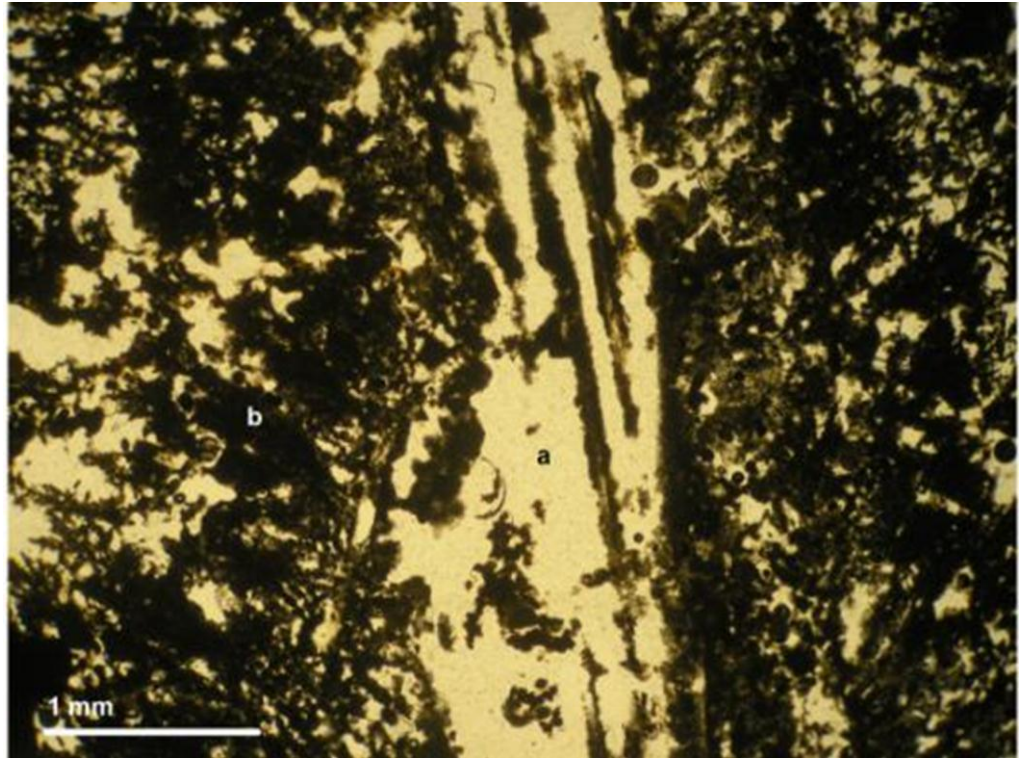


Photo 3: Fenestral void (reed casting) (a) with shrub textures radiating away from void (b). Plane light.

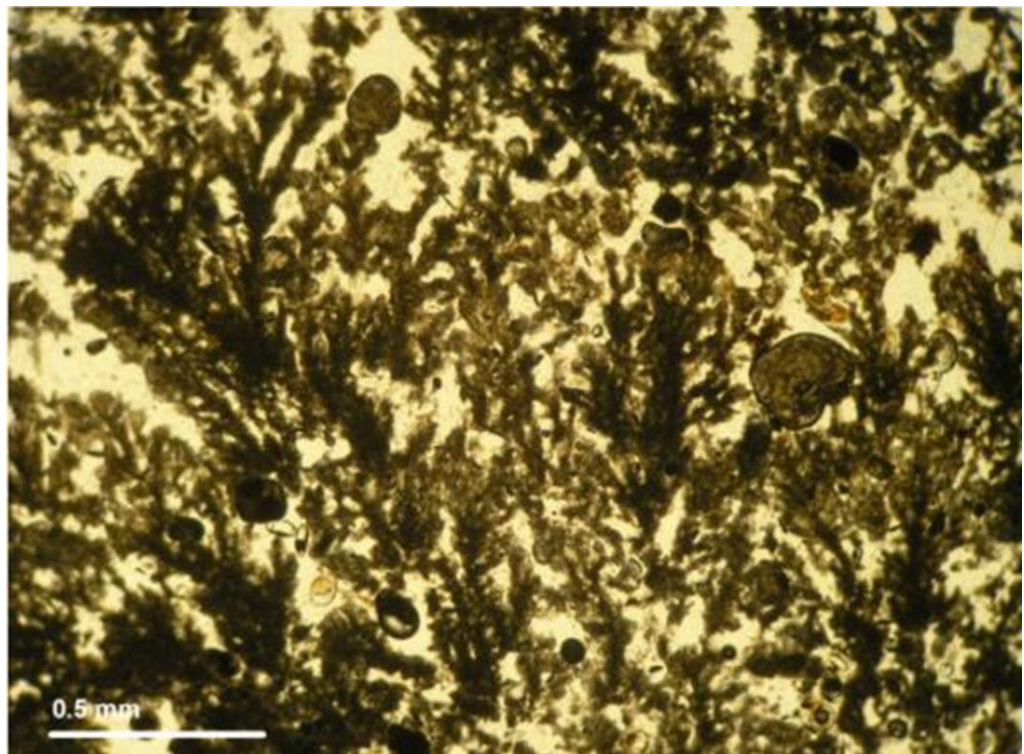


Photo 4: Microbially induced shrub textures in micritic matrix. Plane light.



**Sample No** WSRS0016

**Location**

662325E, 6760621N (GDA94, Zone 53)

**Texture**

Laminar sparry calcite, laminations approximately 0.2-1 mm thick. Inter-laminar vugs and carbonate clasts deposited conformably with laminations present.

**Carbonate Grains**

4% micritic clasts and lumps.

**Siliciclastic Grains**

0.5% quartz sand (largely in clasts/ lumps).

**Voids**

7% partially filled, inter-laminar. Possible evidence for geopetal void fill.

**Carbonate Mud**

5%

**Cements**

50% radial fibrous and bladed, 15% microspar, 4% meniscus, 15% granular and blocky.

**Other**

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**Comments**

Sparry carbonate fracture fill or sheet flow deposit.

**Classification**

Laminated sparstone.

**Interpretation**

Fracture fill or sheet flow carbonate.

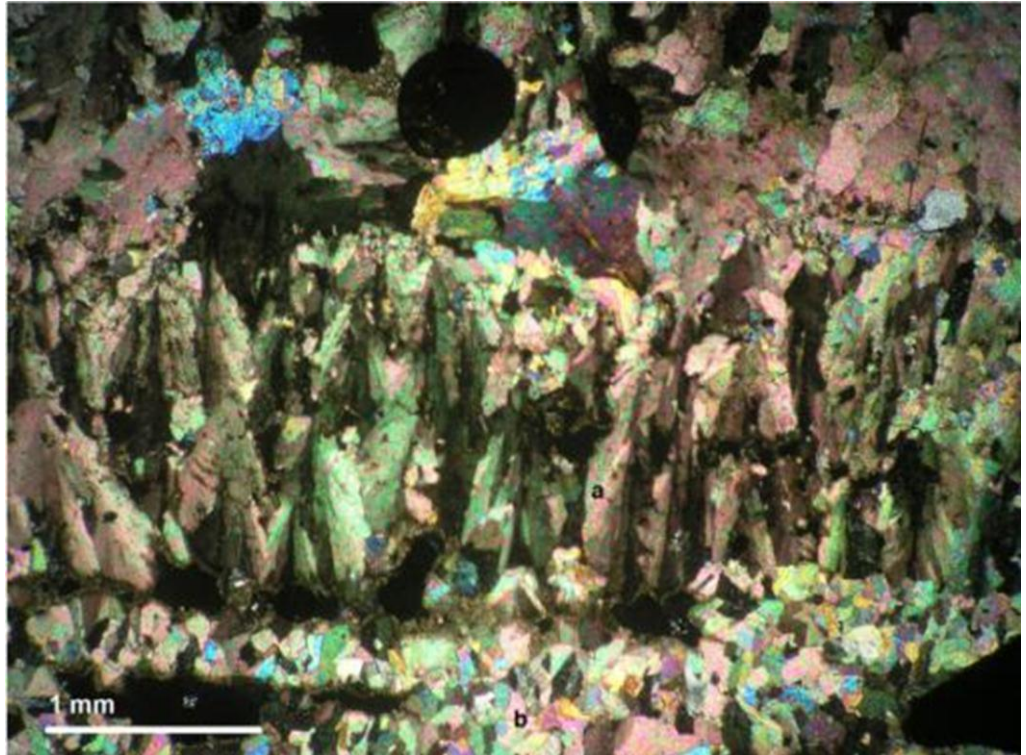


Photo 1: Radial bladed spar (centre) (a) and granular (bottom) (b) cement. Inter-laminar voids partially filled with microcrystalline cement. Crossed polars.

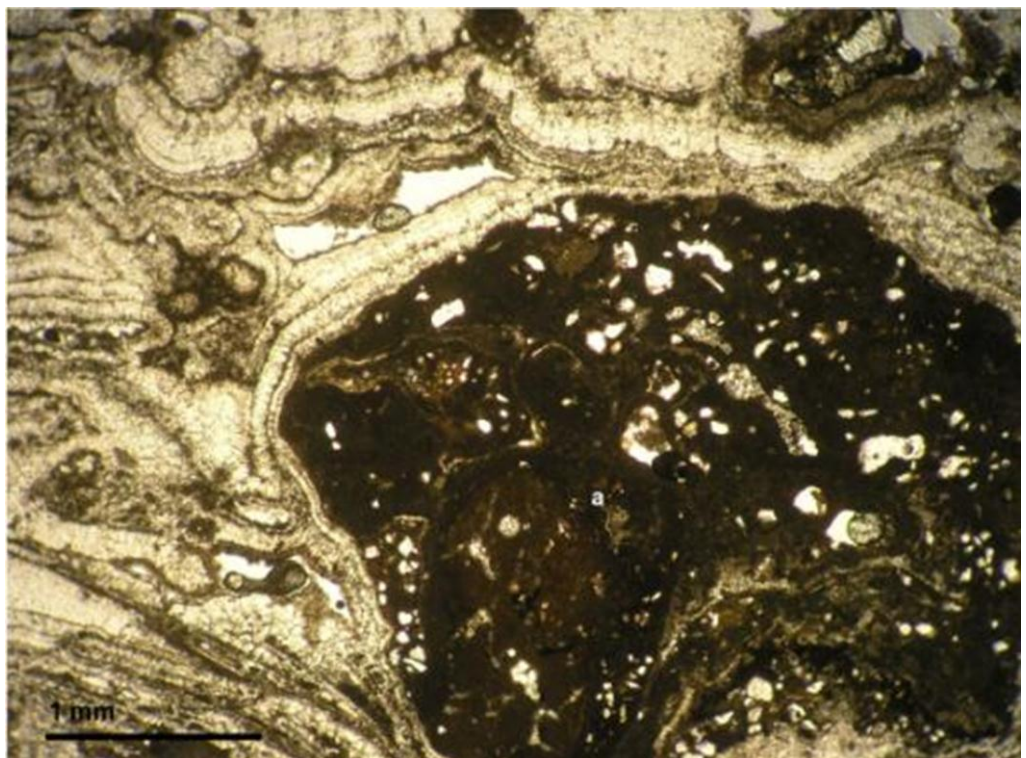


Photo 2: Rounded lump composed of micritic limestone and quartz sand embedded in radiaxial fibrous and microspar cement. Crossed polars.



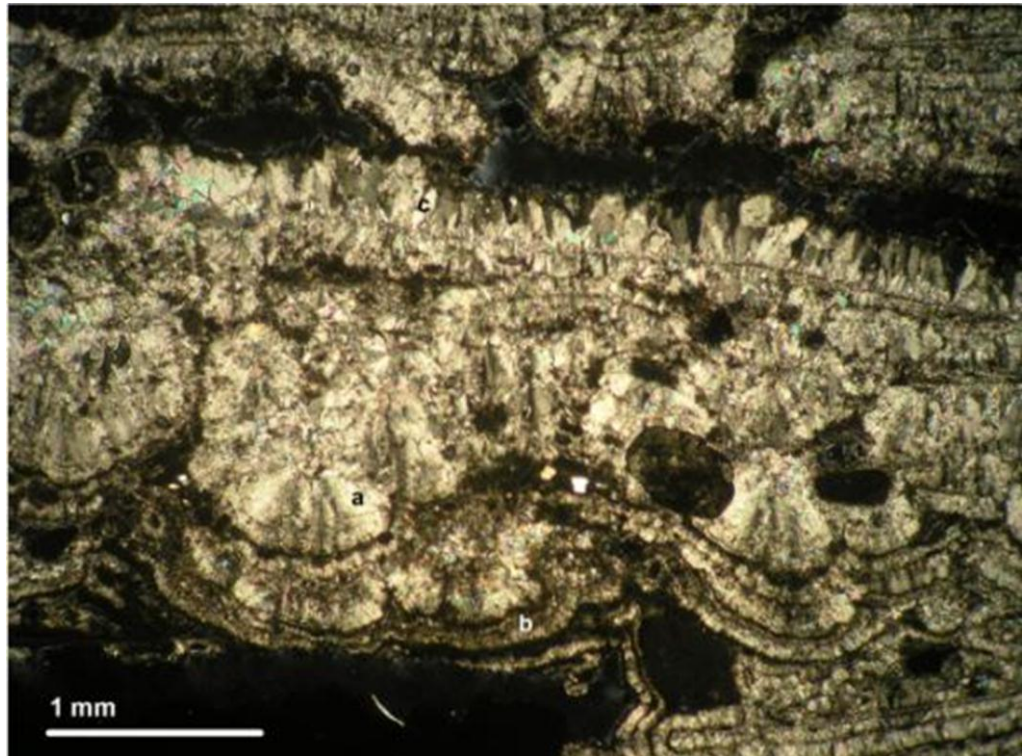


Photo 3: Radiaxial fibrous spar cement (a) with botryoidal habit (centre) with microspar lining (b) and bladed spar cement (c). Inter-laminar void. Crossed polars.

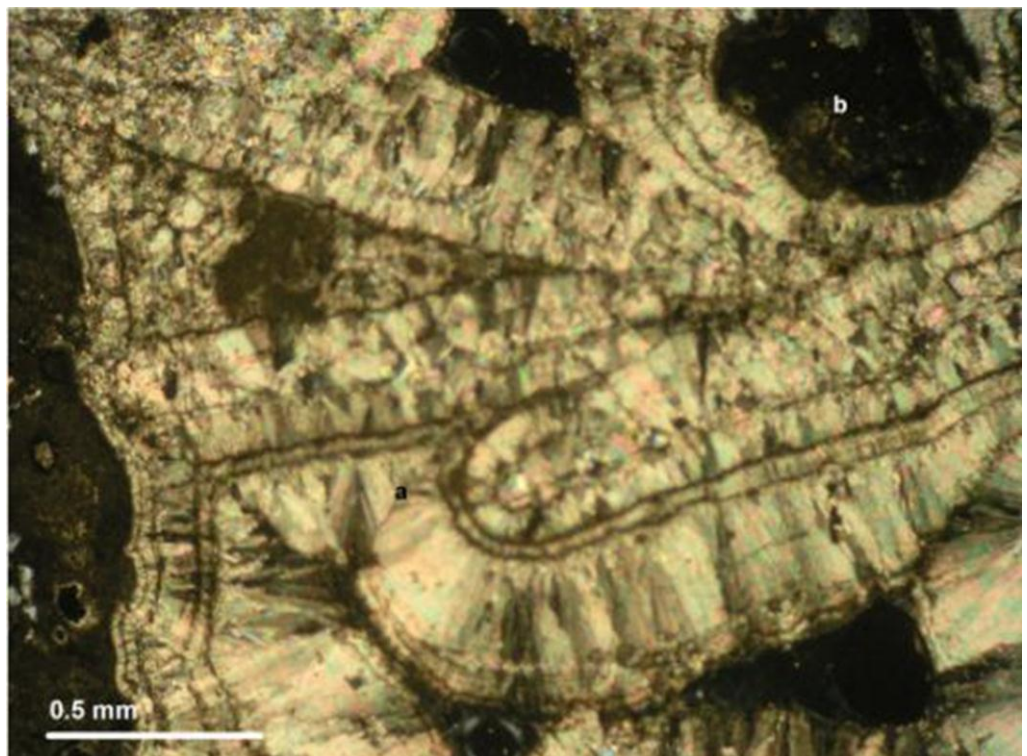


Photo 4: Radiaxial fibrous, bladed, granular and microcrystalline cement showing complex history. Original lamination of bladed spar cement (a) was broken, with subsequent voids filled with firstly laminated microcrystalline and then radiaxial fibrous spar cement. Micritic clasts (b) near top and left hand side of image evident. Crossed polars.

**Sample No** WSR0017

**Location**

662412E, 6760336N (GDA94, Zone 53)

**Texture**

Fine grained massive marly limestone. Fine grained "blotchy" micritic and clayey matrix. Goethite stained.

**Carbonate Grains**

1% oncoids/ ooids, 1% peloids, tr. bioclast, 35% clasts.

**Siliciclastic Grains**

5% quartz sand, 5% clay

**Voids**

15% irregular rounded (possibly fenestral), 5% inter-granular, 1% fracture. 5% partially filled, 15% filled.

**Carbonate Mud**

36%

**Cements**

6% microcrystalline, 7% micritic, 2% granular/ blocky and bladed.

**Other**

7% goethite (matrix).

**Comments**

Microbial textures such as clotting and oncoidal grains still evident. Late stage micrite and clastic void fill. Small shrinkage fractures evident.

**Classification**

Goethitic clastic wackestone

**Interpretation**

Goethite-stained, clastic, paludal limestone originally deposited in tail environment



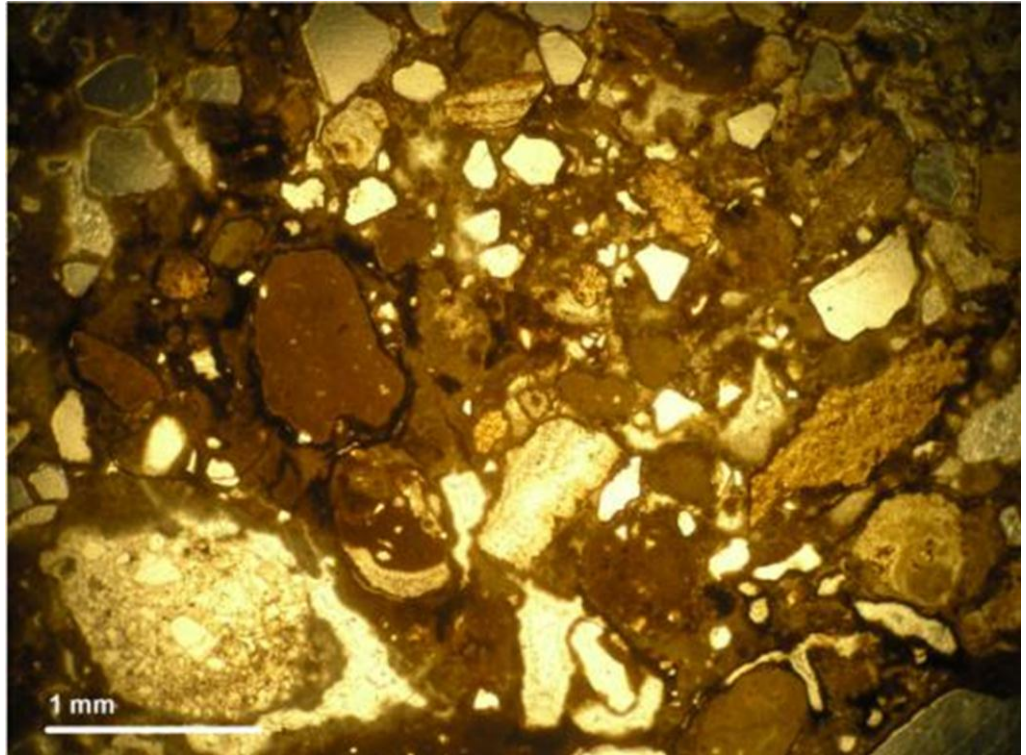


Photo 1: General matrix of sample. High proportion of rounded carbonate and siliceous clasts within a ferrihydrate stained carbonate mud matrix. Microcrystalline spar cement fills inter-granular voids. Plane Light.

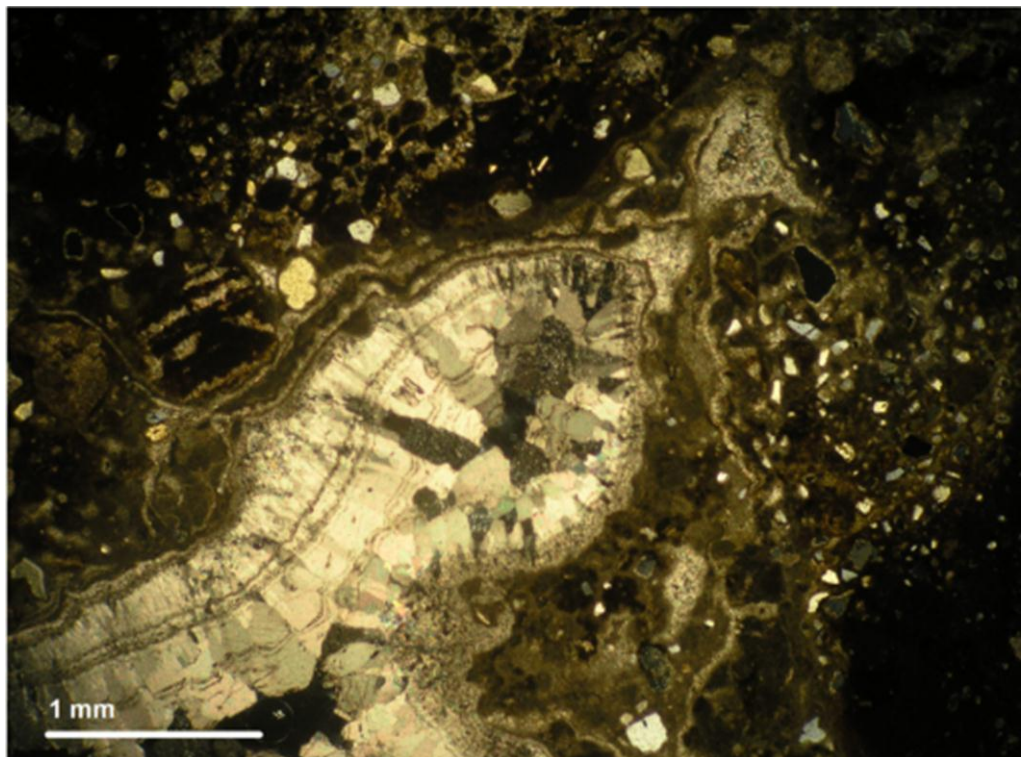


Photo 2: Fenestral? Void fill of laminated microcrystalline, radiaxial fibrous, bladed and finally granular cement. Matrix around void composed of goethite-stained carbonate mud and carbonate clasts with sand grains. Crossed polars.



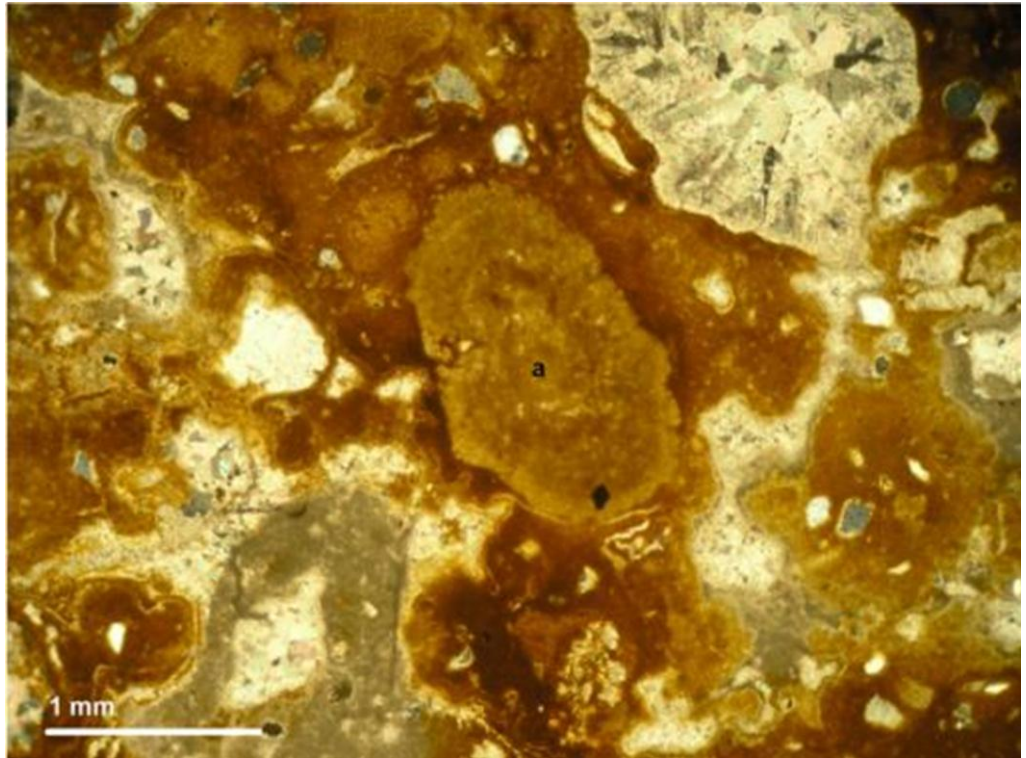


Photo 3: Ooid (a) with concentric laminations still visible despite goethite overprint. Some dissolution is evident around the edges of the grain. Void fill composed of microcrystalline and bladed carbonate cement. Plane light.

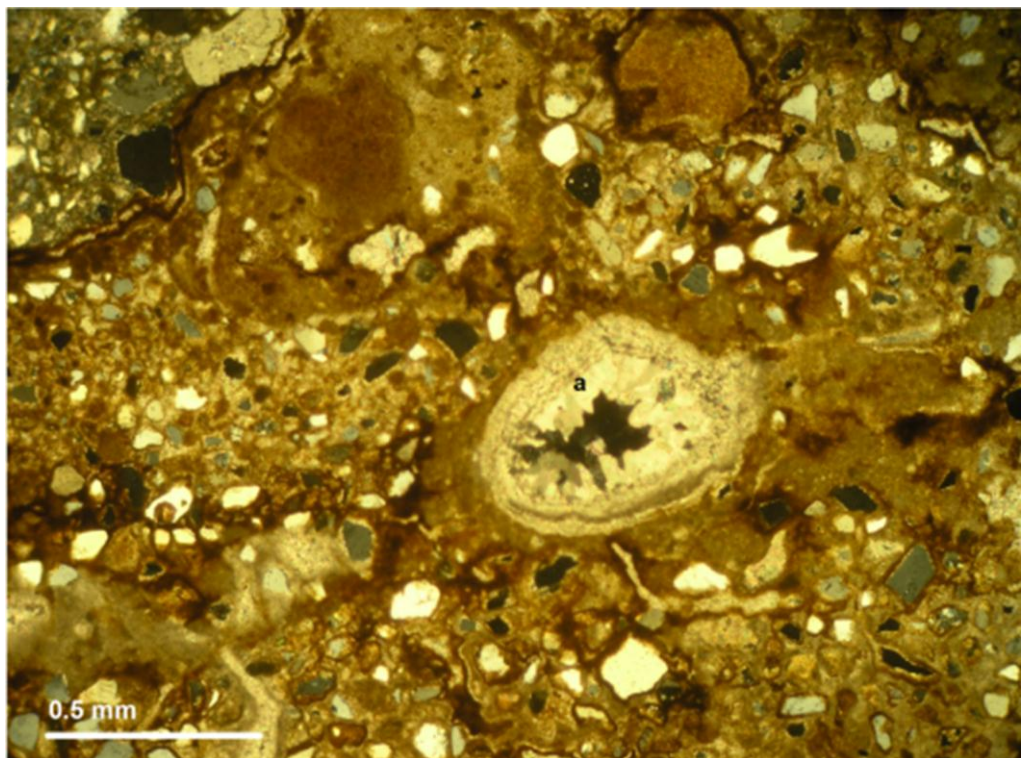


Photo 4: Fenestral (?) void (a) filled with laminated microcrystalline and bladed carbonate cement within matrix of goethite-stained carbonate clasts and mud and quartz sand. Crossed polars.



**Sample No** WSRS0018

**Location**

662310E, 6760485N (GDA94, Zone 53)

**Texture**

Fine grained crystalline limestone within fracture, with highly sinuous to botryoidal lamination texture. Very fine grained microspar texture.

**Carbonate Grains**

-

**Siliciclastic Grains**

2% clay inter-laminar inclusions

**Voids**

0.5% dissolution, 0.4% partially filled

**Carbonate Mud**

None

**Cements**

93% microcrystalline, aragonitic acicular and xenotopic granular texture, tr. meniscus and microspar cement in voids, 5% fibrous (microspar).

**Other**

-

**Comments**

Lamination texture likely to be microbial in origin.

**Classification**

Fracture fill aragonitic microsparite

**Interpretation**

Fracture fill spar

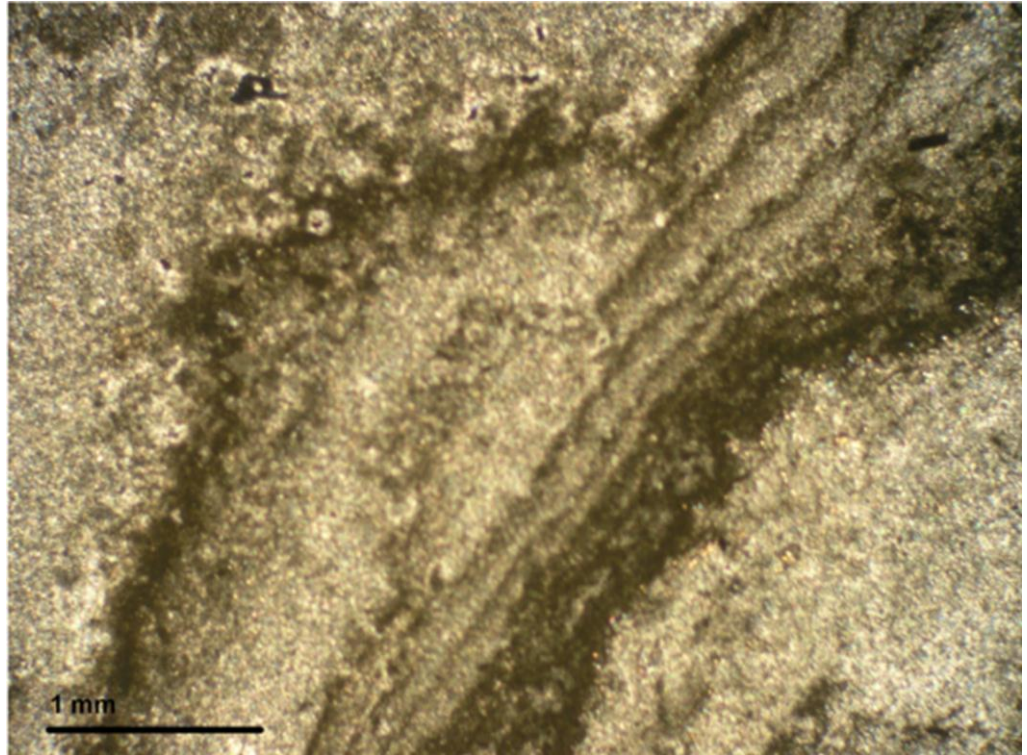


Photo 1: Sinuous laminations highlighted by opaque clay particles in very fine grained crystalline carbonate matrix. Laminations may have microbial origin. Crossed polars.

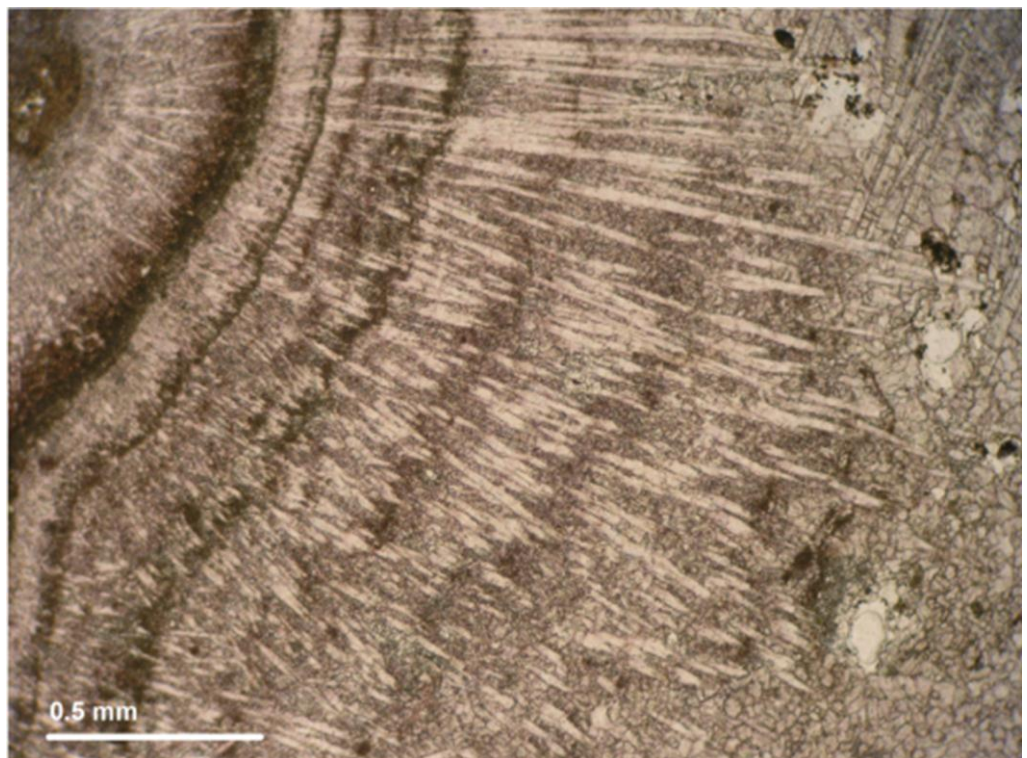


Photo 2: Radiating acicular aragonite within generally sinuous laminated spar texture. Stained section. Crossed polars.



**Slide descriptions for samples collected at Strangways Springs**

**Sample No** SSRS001

**Location**

650081E, 6772214N (GDA 94, Zone 53)

**Texture**

Fine grained, massive yellow semi consolidated sandstone.

**Carbonate Grains** -

**Siliciclastic Grains**

80% quartz sand

**Voids**

Tr. inter-granular.

**Carbonate Mud**

-

**Cements**

-

**Other**

14% clay (kaolinite), 5% jarosite, 1% feldspar (plagioclase), tr. zircon.

**Comments**

Quartz grains generally well rounded – between 0.01 and 0.5mm in diameter, but mostly in the 0.1 to 0.2 mm range. Iron oxide staining and jarosite suggest a previously reductive environment

**Classification**

Sandstone.

**Interpretation**

Pool environment.

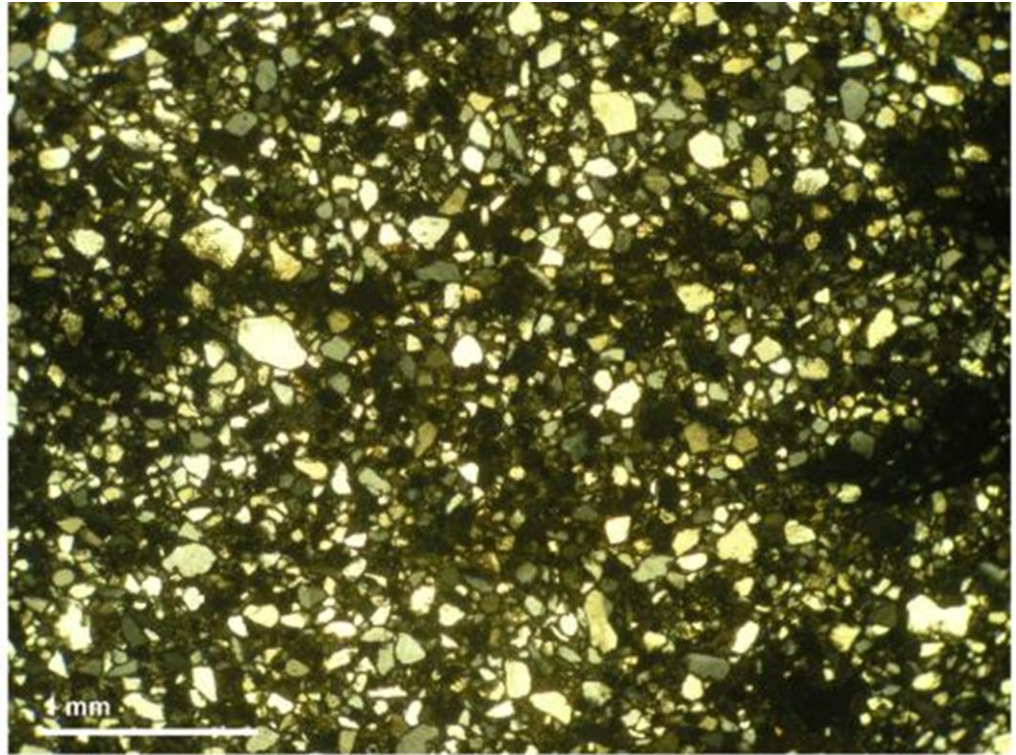


Photo 1: General sandstone matrix composed of rounded to sub angular quartz grains in a clay matrix.  
Crossed polars.



**Sample No** SSRS002

**Location**

650093E, 6772222N (GDA 94, Z53)

**Texture**

Vuggy limestone. Thrombolytic, botryoidal and clotted texture.

**Carbonate Grains**

5% oncoids, 2% peloids.

**Siliciclastic Grains**

-

**Voids**

15% fenestral and inter-particle, 5% dissolution voids. 7% filled, 8% partially filled 5% unfilled.

**Carbonate Mud**

70% incorporated into microbial structure (Thrombolytic, botryoidal and, oncoidal textures).

**Cements**

15% microcrystalline, 1% bladed, 1% granular.

**Other**

2% Goethite (staining and particulate), 1% manganese oxide (ovoid particulate, dendritic void fill).

**Comments**

Well defined microbial fenestra largely filled with microcrystalline spar evident. Laminations that are present appear associated with microbial activity. Peloids may be formed from disaggregated surficial crystal precipitates from cyanobacterial stems. Flowing water was possibly turbulent due to the presence of manganese oxide and goethite (oxygenation due to turbulence leading to precipitation of oxides).

**Classification**

Microbial wackestone.

**Interpretation**

Shallow poorly vegetated mound environment.

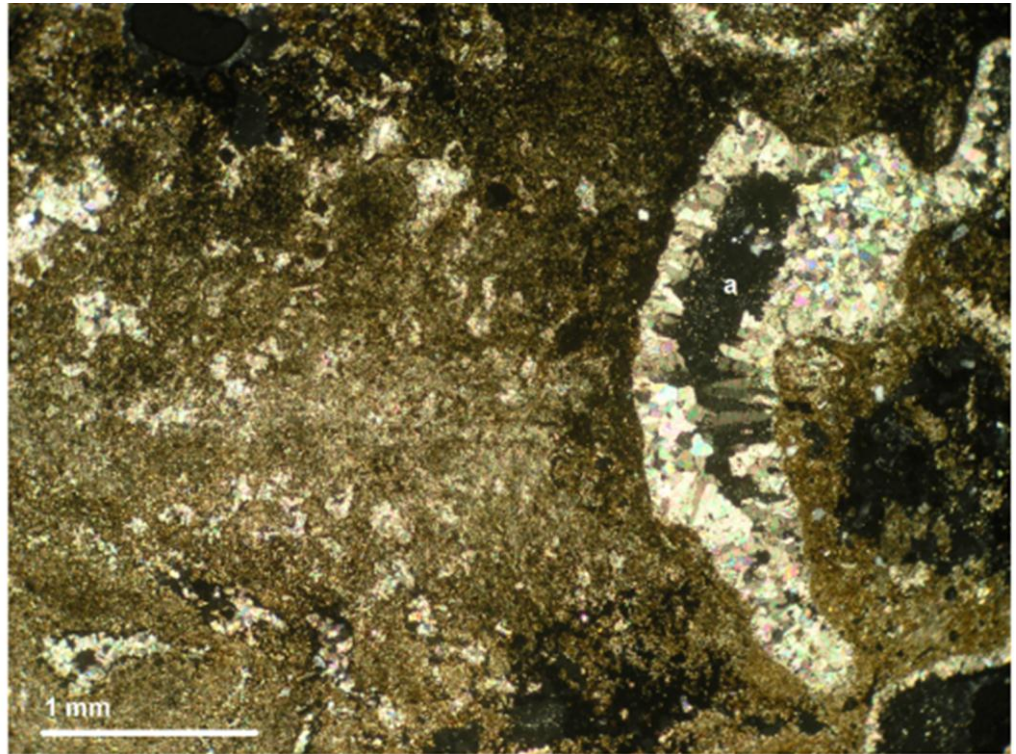


Photo 1: Clotted micritic groundmass with some neomorphic alteration to microspar. Fenestral void to right (a) partially filled with bladed and granular spar. Crossed polars.

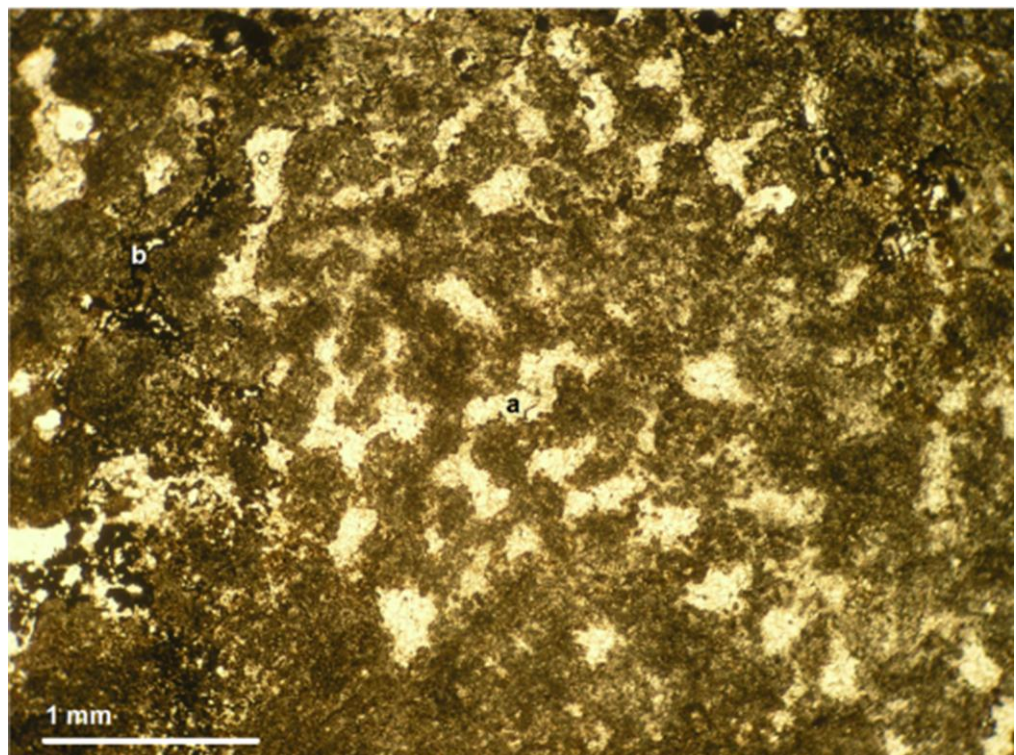


Photo 2: Thrombolytic textured micrite after microbial activity. Microbial fenestra (example at a) filled with microspar cement. Manganese oxide void fill to left of image (b). Plane light.



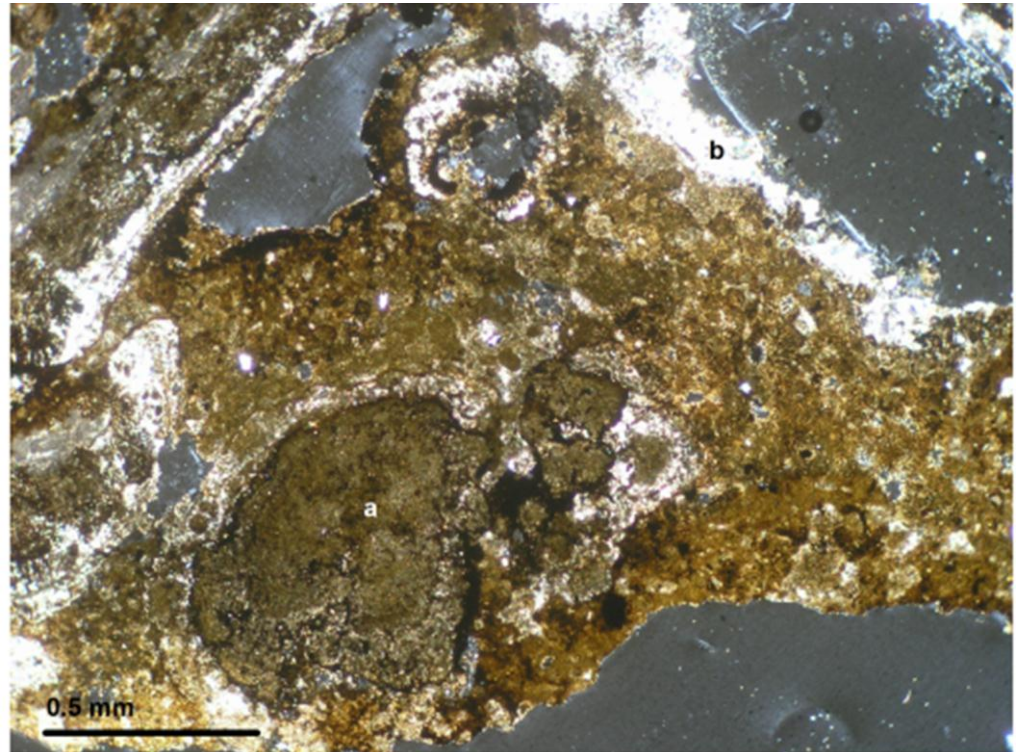


Photo 3: Porostromate oncolite (a) in matrix of peloidal and clotted micrite. Voids partially filled with microspar (b). Manganese oxide is also observable. Crossed polars.

**Sample No** SSRS005

**Location**

650076E, 6772207N (GDA 94, Zone 53)

**Texture**

Very Vuggy limestone. Mainly peloidal carbonate grains with small percentage. Vugs are both bridging and fenestral.

**Carbonate Grains**

15% peloids, 10% ooids, 5% lumps, 1% oncoids, 1% bioclasts.

**Siliciclastic Grains**

5% quartz silt and sand.

**Voids**

40% cavities up to 10 mm in diameter. 20% unfilled, 10% partially filled, 10% filled

**Carbonate Mud**

10% clotted/ microbial textured.

**Cements**

25% microcrystalline, 5% meniscus, 1% bladed.

**Other**

5% manganese oxide, 3% goethite

**Comments**

Presence of large number of primary voids, abundance of microcrystalline cementation, and occurrence of ooids is indicative of a relatively high energy environment that may have been subject to sub-aerial conditions (such as a small waterfall or vegetated drape).

**Classification**

Fenestral ooidal grainstone.

**Interpretation**

Spring limestone deposit from vegetated slope of mound.



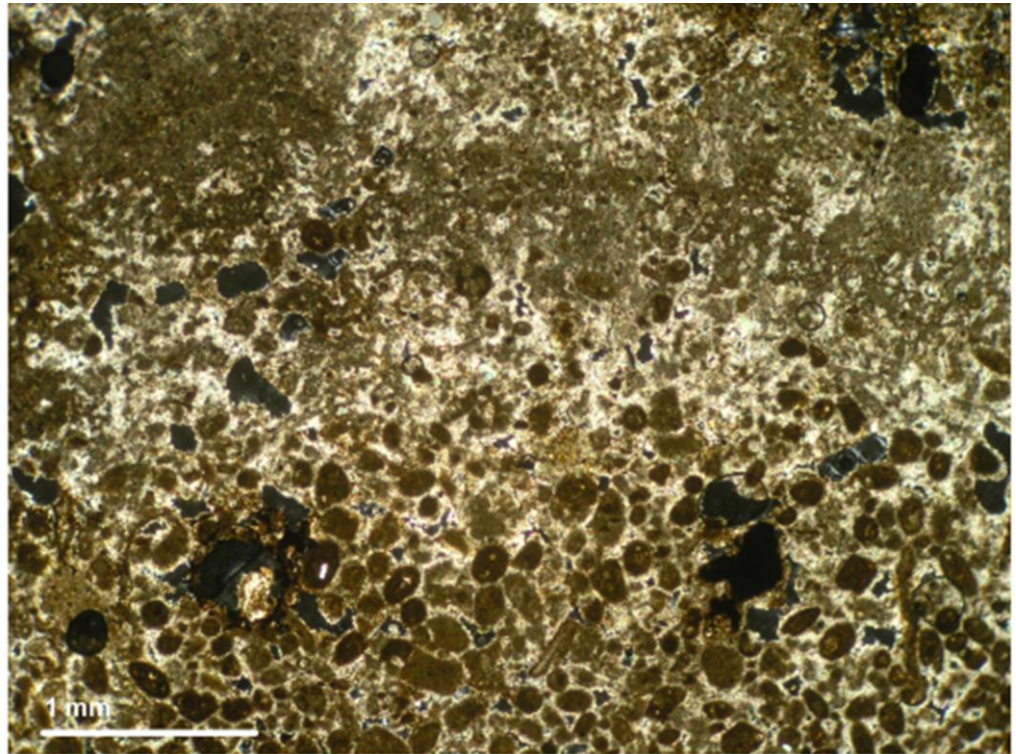


Photo 1: Ooidal and peloidal carbonate matrix within lower half of image, with clotted micrite in upper half. Microspar and meniscus inter-granular void fill between carbonate grains. Cross polars.

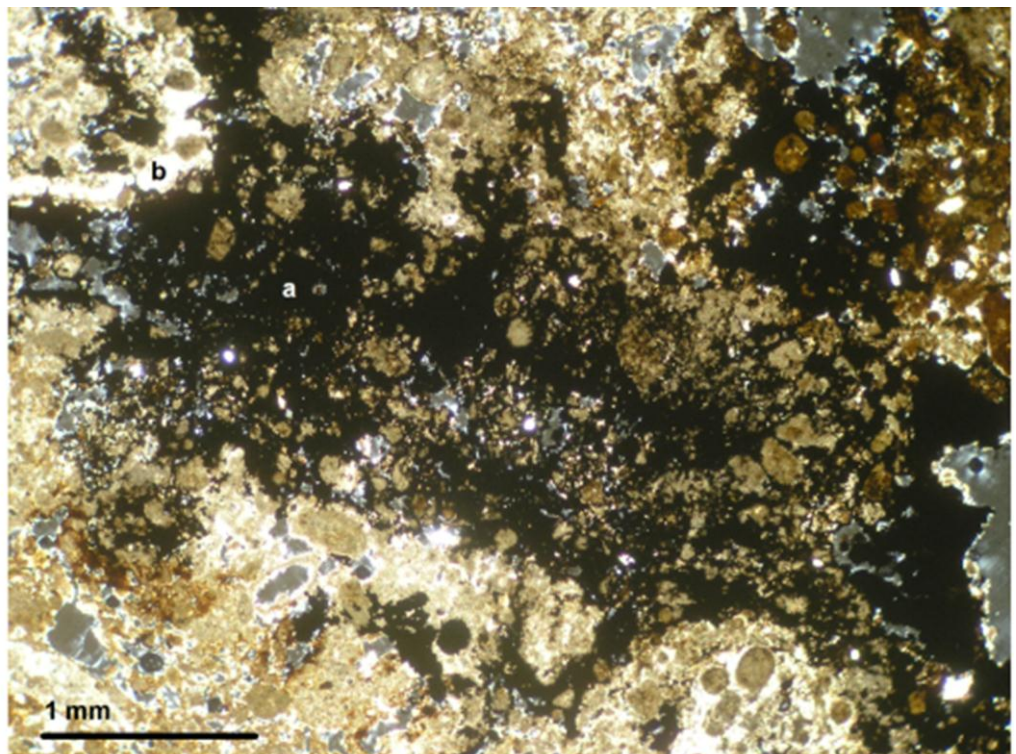


Photo 2: Ooidal and peloidal carbonate matrix with manganese oxide (a) and microspar (b) inter-granular cement. Crossed polars.



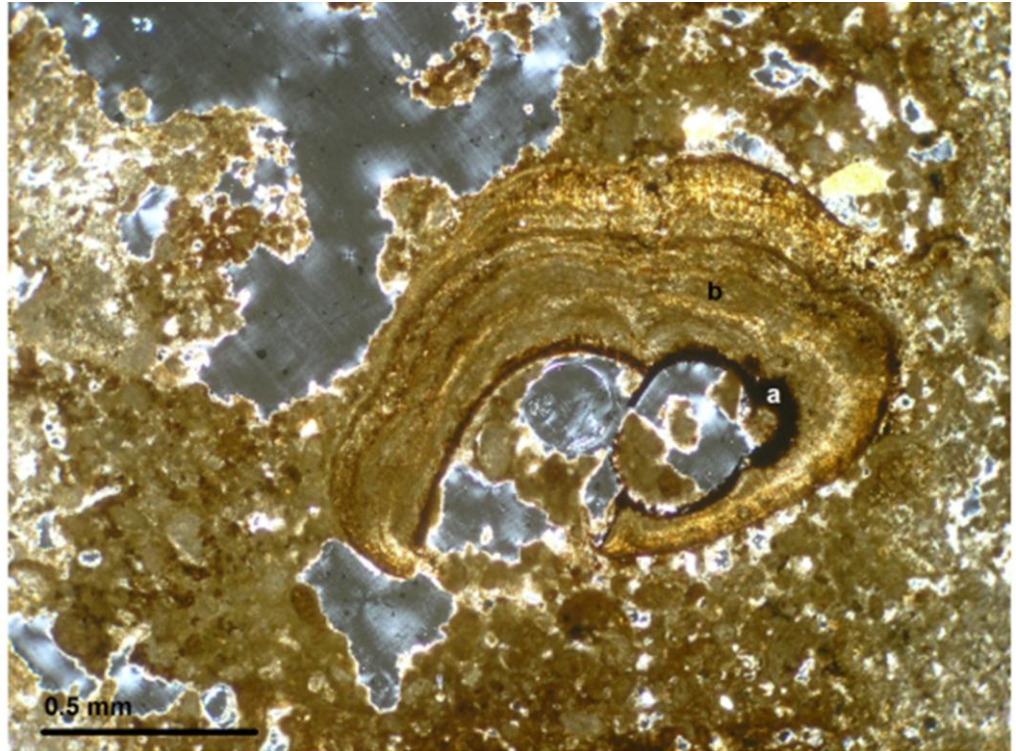


Photo 3: Gastropod bioclast (a) with overgrowth of laminated microbial of microbial micrite. Microbial micrite is geopetal and appears to display two generations of growth. Crossed polars.

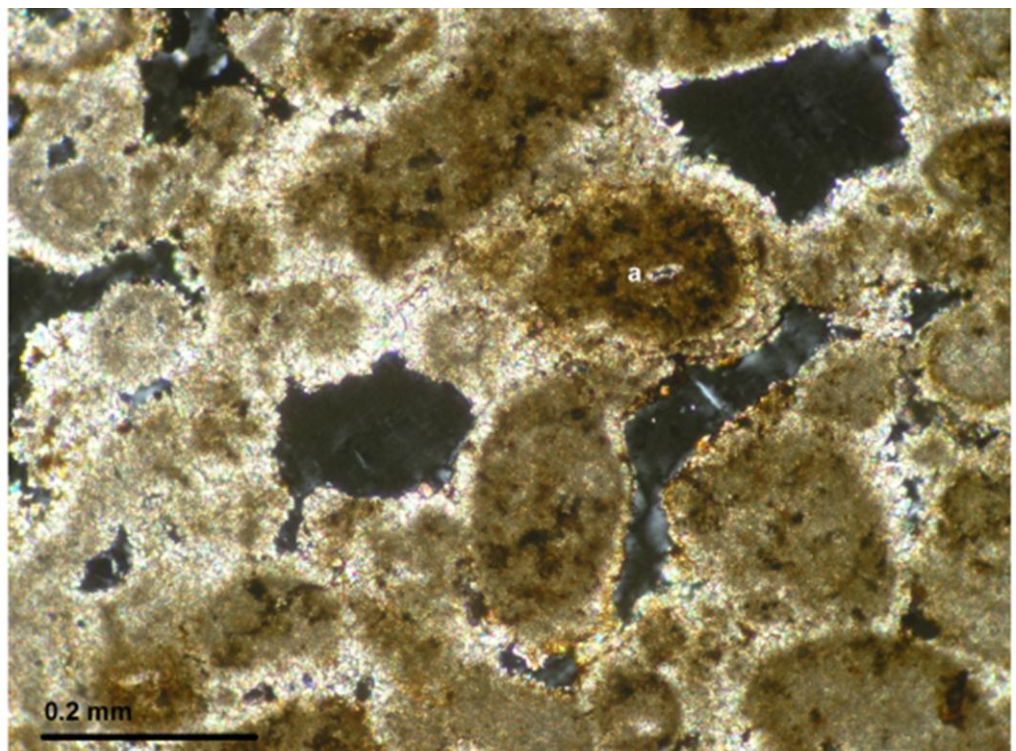


Photo 4: Magnified view of ooids, with void (a) present where nucleus of ooid was formerly present. Microcrystalline spar inter-granular and meniscus cement also present. Crossed polars.



**Slide descriptions for samples collected at Coward Springs**

**Sample No** CSRS0001

**Location**

674419E, 6745702N (GDA 94, Z53)

**Texture**

Vuggy carbonaceous rock with thick laminated to anastomosing (lattice-like) sparry cement and fine grained clotted and microbial micritic groundmass.

**Carbonate Grains**

5% oncoids, 7% peloids 1% lumps, 5% calcareous clastic grains.

**Siliciclastic Grains**

Tr. quartz sand.

**Voids**

37% fracture, 5% fenestral (microbial fenestra), 20% filled, 20% partially filled.

**Carbonate Mud**

40% incorporated into microbial structure (thrombolytic and oncoidal textures).

**Cements**

10% microcrystalline, 2% meniscus, 10% radiaxial fibrous zoned.

**Other**

Tr. goethite (staining and grains), tr. manganese oxide.

**Comments**

Multiple-stage fracturing evident by cross-cutting relationships. Deposition took place in sub-aerial environment with development of microbial textures (thrombolytic and oncoidal).

**Classification**

Microbial boundstone.

**Interpretation**

Late stage fracture-fill spring channel limestone deposit.

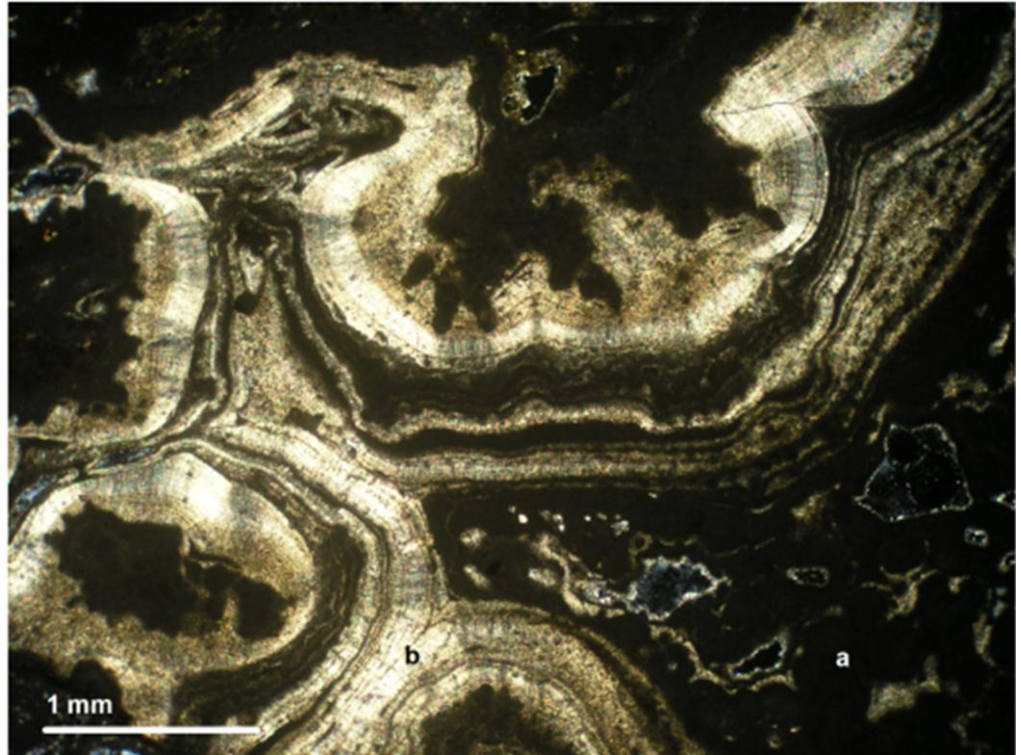


Photo 1: Thrombolytic and shrub-like textured micrite (a) with fenestra partially filled with microcrystalline spar. Laminated fibrous and bladed carbonate cement interlayered with microbial micrite void fill (b). Boundary between micritic matrix and spar void fill appears transitional. Cross polars.

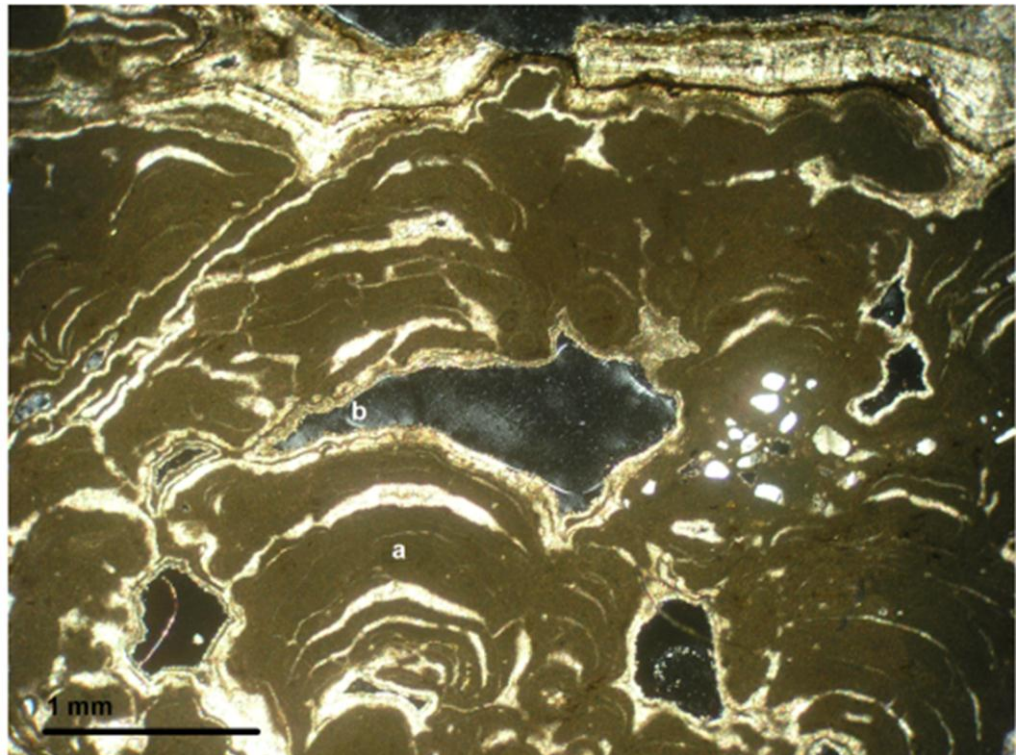


Photo 2: Botryoidal microbial micrite (a) with fenestral void filled with microcrystalline spar (b). Clastic quartz sand grains also present in matrix. Crossed polars.



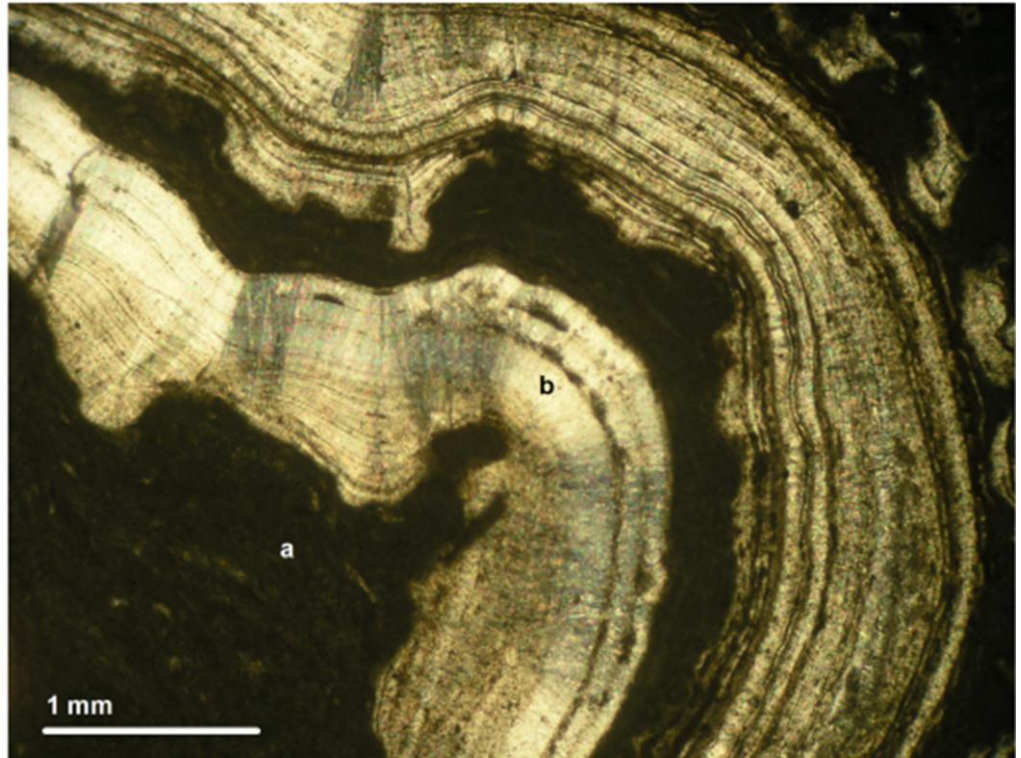


Photo 3: Laminations composed of clotted and peloidal micrite (a) and bands of laminated fibrous sparry cementation (b). Crossed polars.

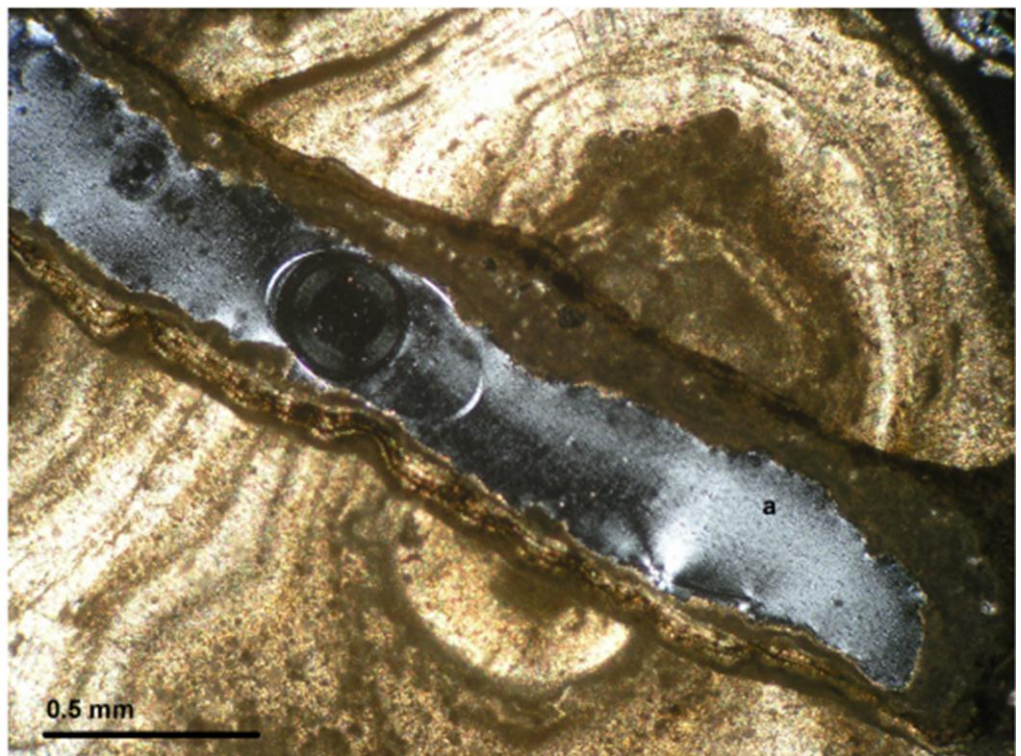


Photo 4: Oncoid grain and laminated radiaxial fibrous and microcrystalline spar cement that has been fractured, with the fracture (a) partially filled with microspar and micrite groundmass. Crossed polars.