This handout is an example of an alternative exercise used on the Access Anglesey field course. It was laminated and taken into the field for use by those who were unable to fully visit the outcrops themselves as a relevant parallel experience. For more details see https://accessanglesey.leeds.ac.uk/
Note: the students had access to hand specimens that are not shown here.

UNIVERSITY OF LEEDS

Exercise: Red Wharf Bay

Limestones and Sandstones

Access Anglesey was designed and delivered as part of the Embedding and Sustaining Inclusive STEM Practices (IncSTEM) project, funded by the Office for Students (OfS).

Red Wharf Bay geology

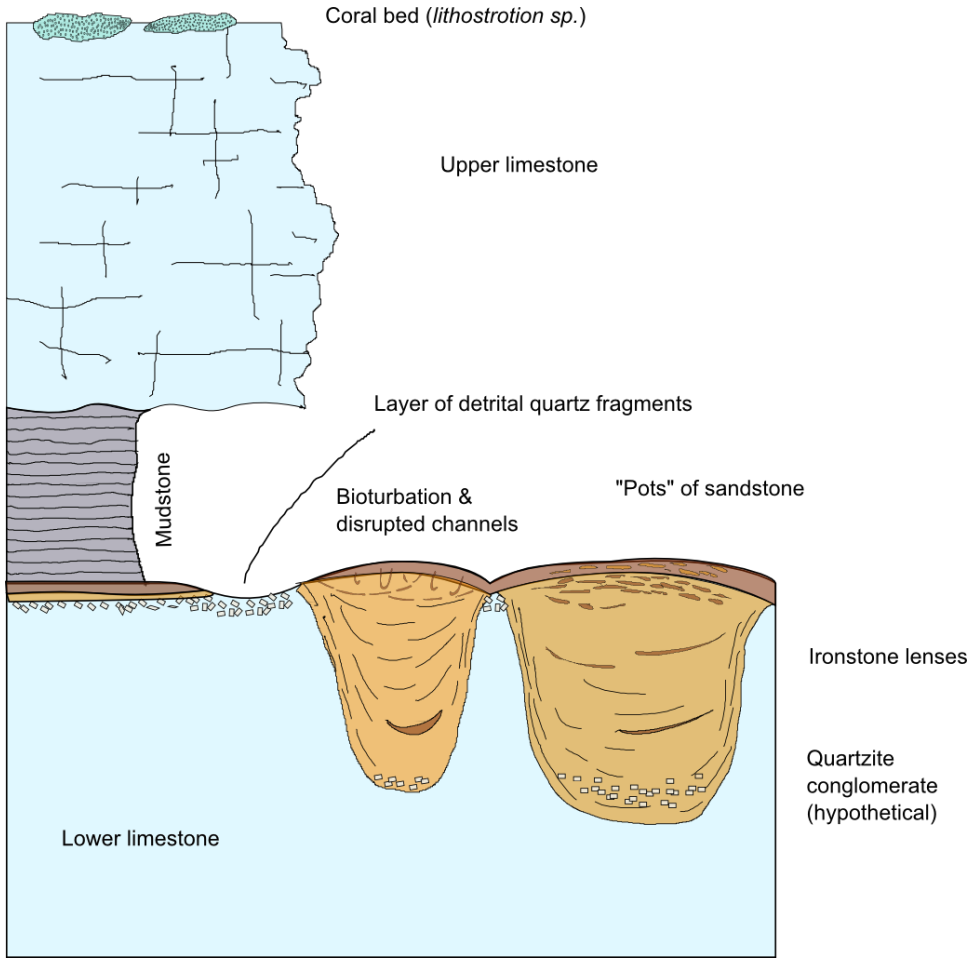
- Red Wharf Bay is an area where we can study Carboniferous age rocks. These are slightly atypical versions of what are known as Yoredale cycles (see guidance), based on examples from Yorkshire.
- We hope to have the relay system up and working here to allow people to get a view of the rocks which are less accessible.

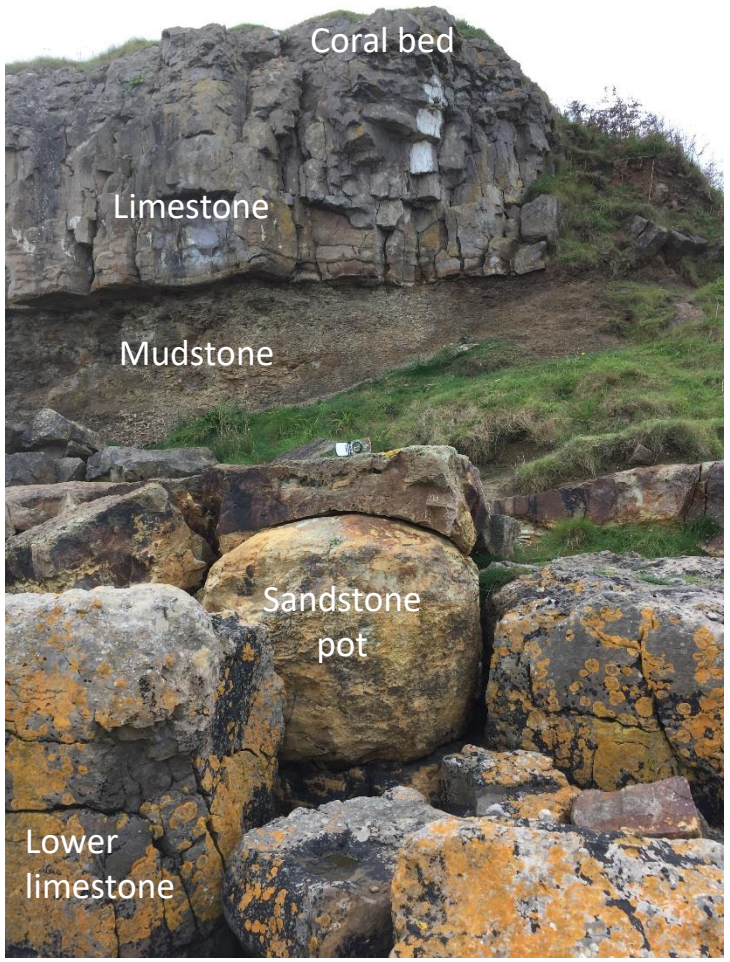
A tale of three lithologies

- The rocks here consist of limestones, sandstones and mudstone/shale. There are hand specimens of the sandstone and limestone; the context of these is particularly interesting

- The shales tend to be found in undercut areas, which are dangerous, so we don't have samples.
- The task is to understand what each rock signifies and how they are related to each other
- We'll start with the field relation:

Outcrop scale field relation





Task 1

- We have some hand specimens and sawn slabs of two of the rock types found here at Red Wharf Bay.
- Look at the hand specimens. Compile a hand specimen description for each:
  - Colour, density, hardness and cementation
  - Mineralogy if possible
  - Grain size and sorting
  - Any other components, such as sedimentary structures, fossils, cement, lithic fragments and so on
- What environment would you tentatively ascribe to each rock type, and why?

Detrital quartzite fragments in a carbonatic matrix; a variable layer a few cm thick sits on top of the limestone and beneath the brown ironstone cap on top of the sandstone pots (see schematic log/beach profile on slide 4).

Task 2

- Considering the field relationship, and the detrital quartz bed on the junction, what has possibly happened, and how could these rocks have become juxtaposed?

Task 3: extended analysis

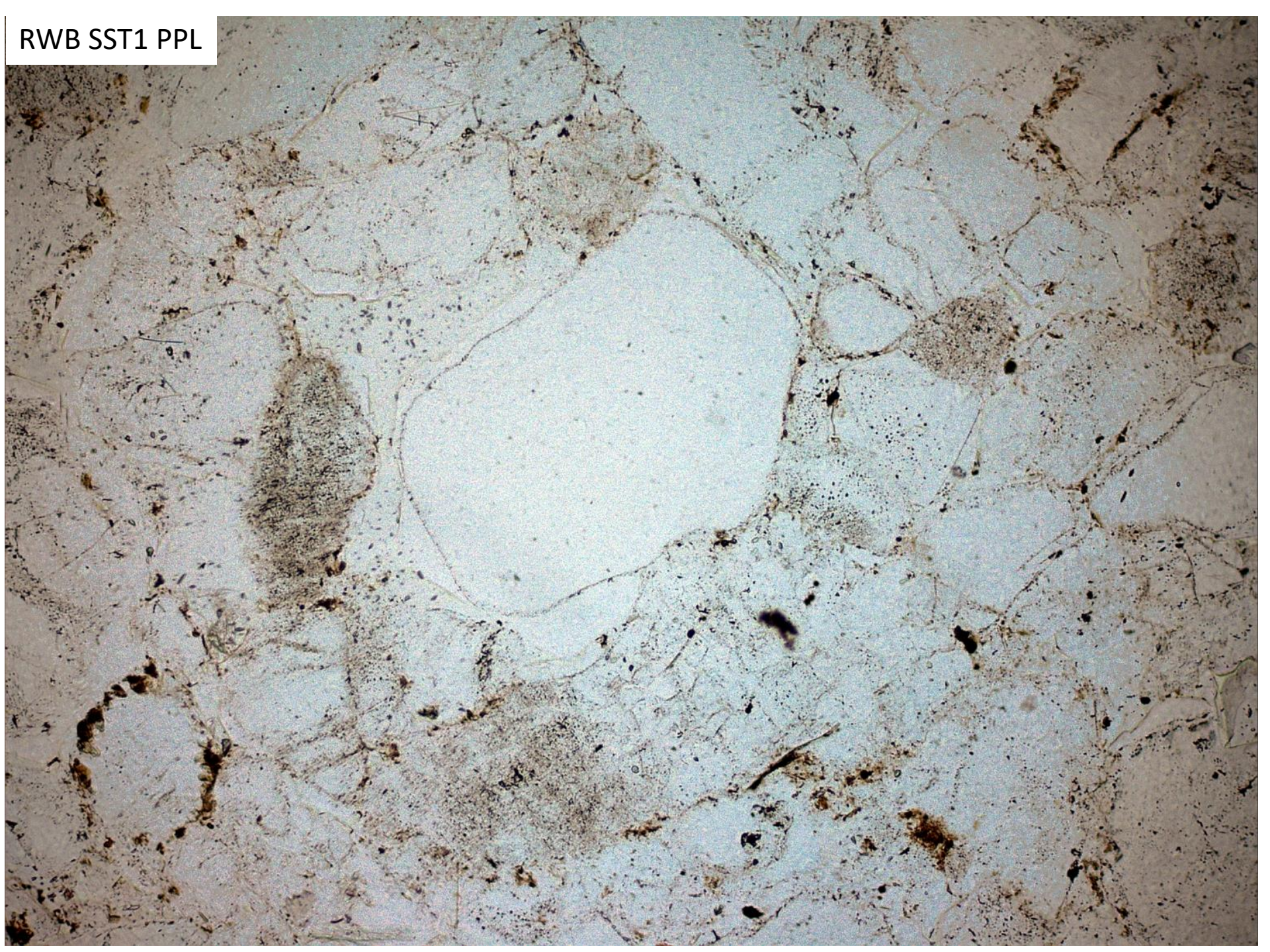
- Beyond the most accessible conclusions that can be derived from field and hand study, we also have some thin section material for each rock type, available as a series of photomicrographs.
- We will explore this to add to your initial descriptions.

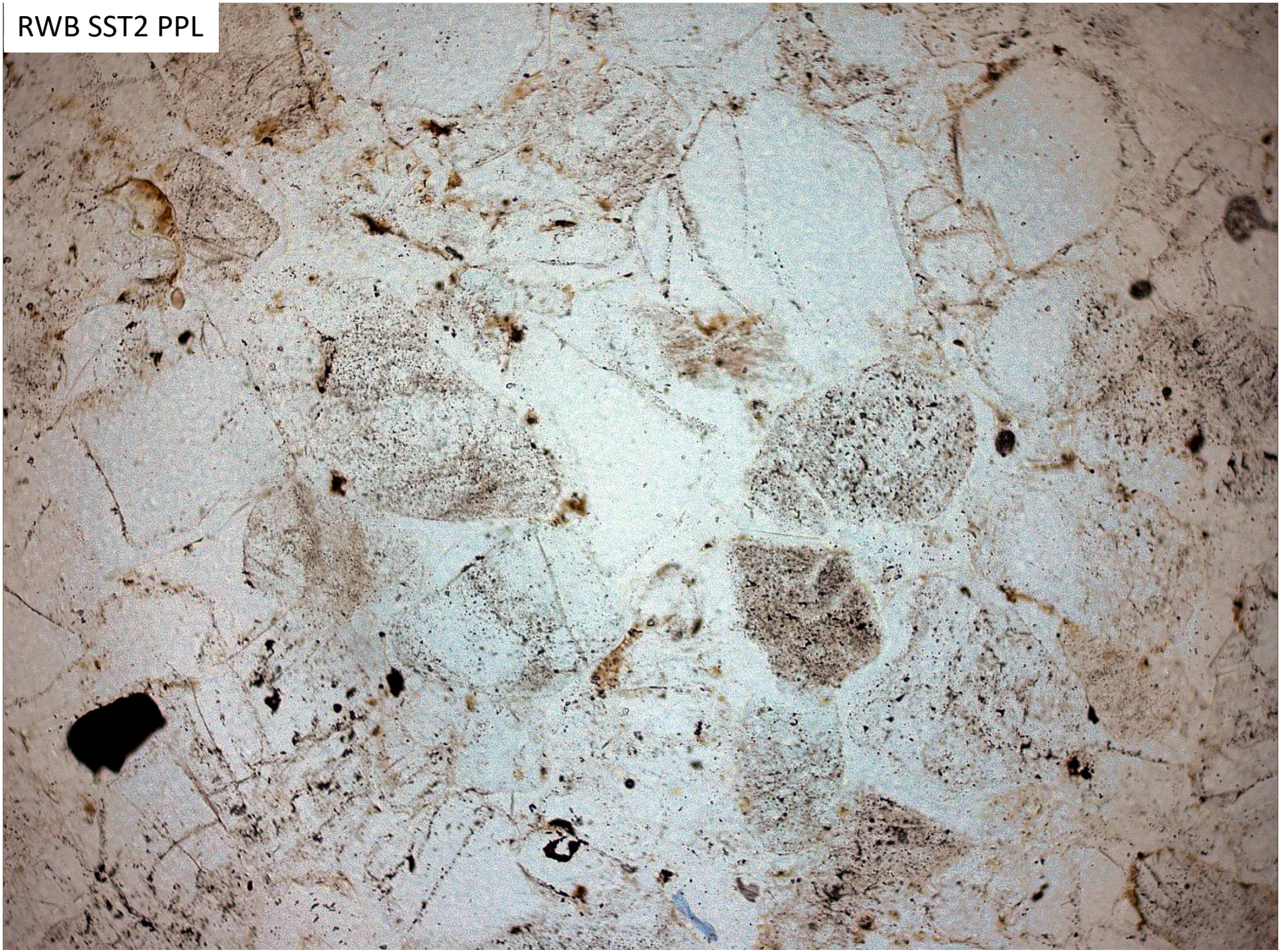
For the sandstone, look first at the grains in **plane polarised light** (first three images). You should be able to see quite well-defined grains, picked out by a very fine layer of red **haematite** dust. Sometimes you see this on grain edges; in other cases you may see entire coated faces, making a whole grain look dusty. The thin section for this is **slide 01**, if you wish to look back at base.

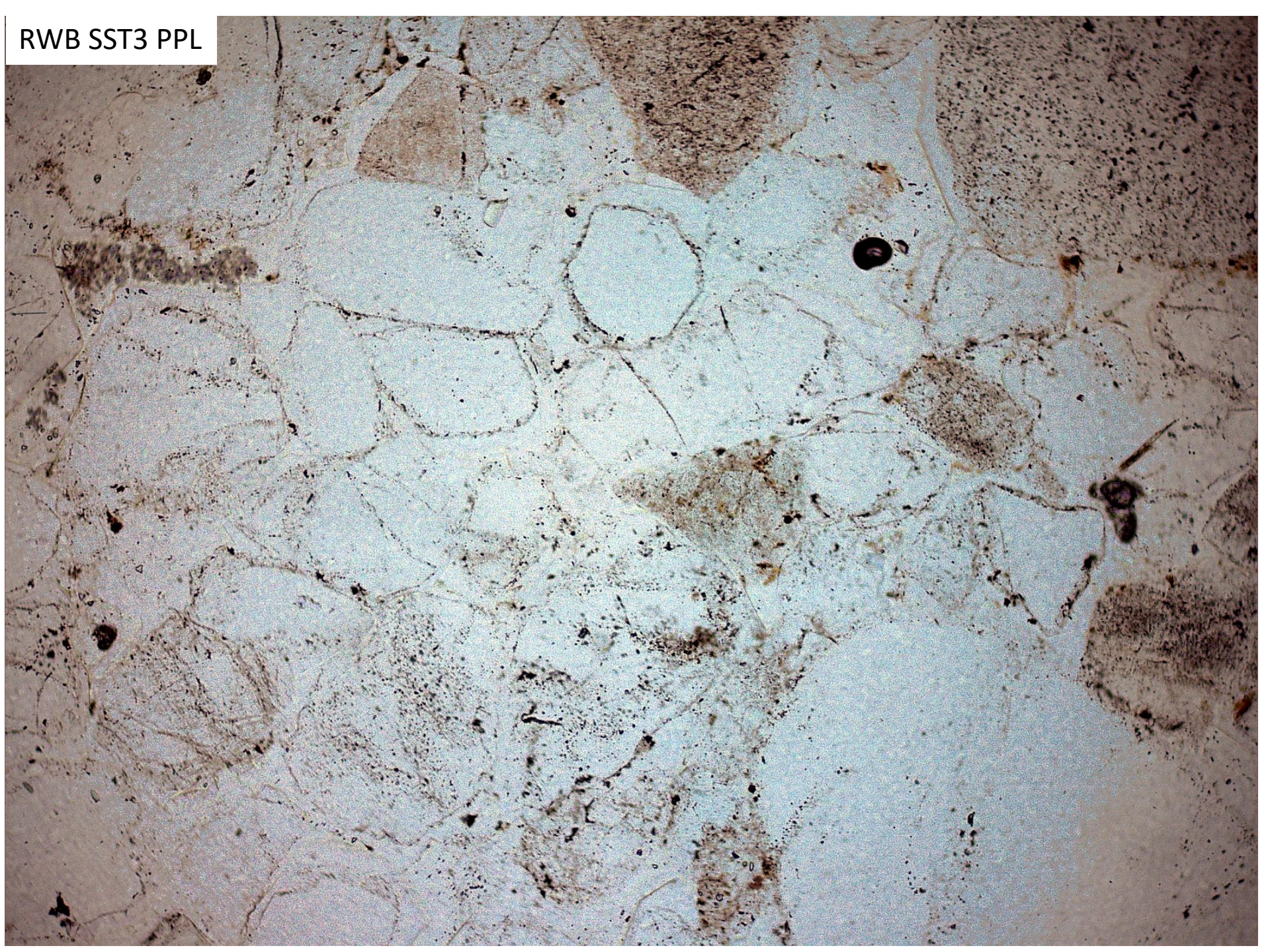
Consider sketching what this looks like.
What kind of porosity would this sand have had at deposition?

Can you assess the grain roundedness and sphericity (i.e. textural maturity) of the sample (use the geological info handout)?

What sedimentary environment do these observations suggest?


RWB SST1 PPL


RWB SST2 PPL


RWB SST3 PPL

Next, we'll compare how this specimen looks under **cross polarised light**. We will then be able to see what this tells us about both the mineralogy, and also of what has happened since sedimentation, and the nature of the cementation in the sample.

By reference to the layer of haematite, which should still be visible, we can examine the cement.

What is the cement made of?

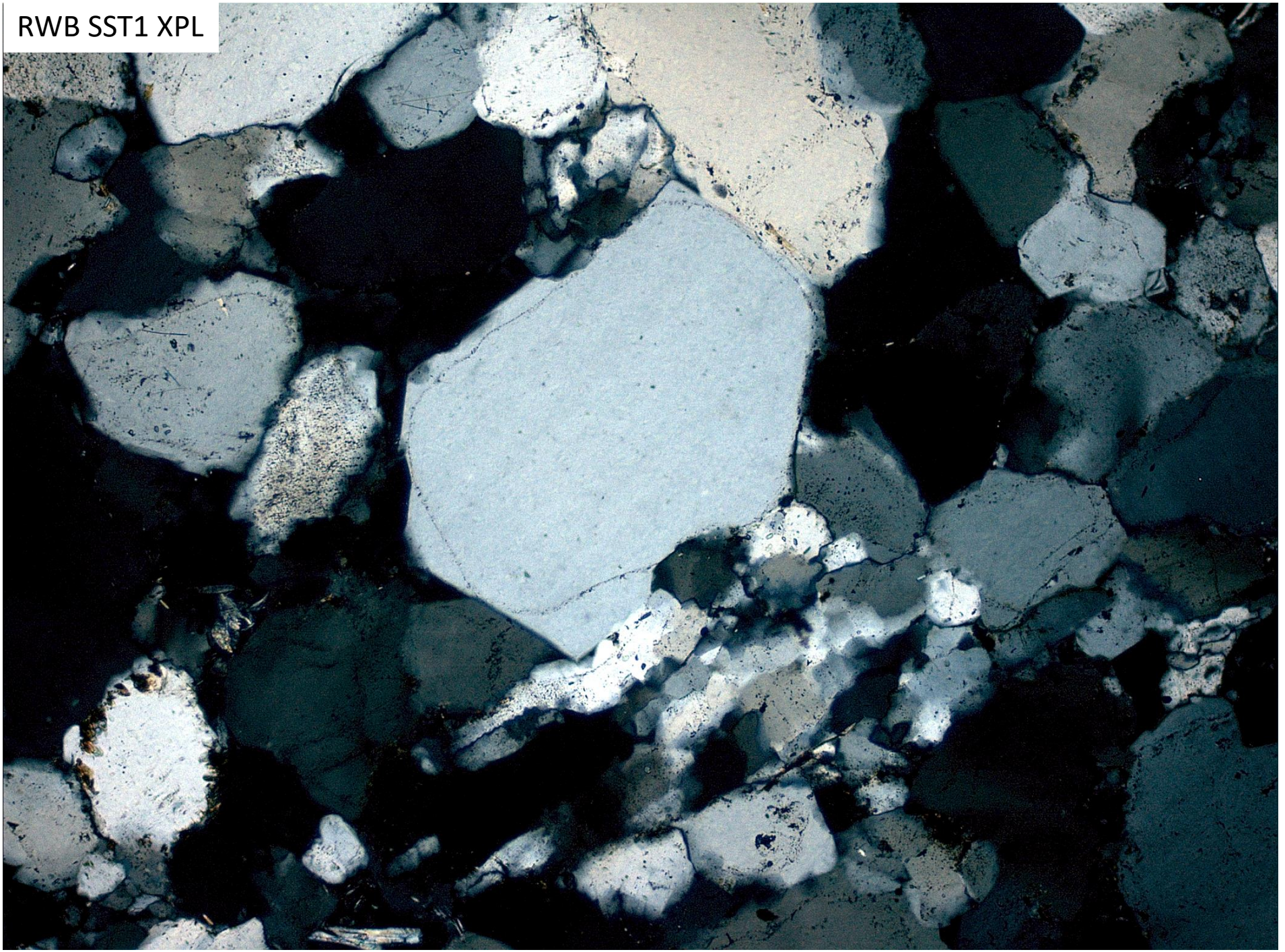
How does it relate to the mineral grains?

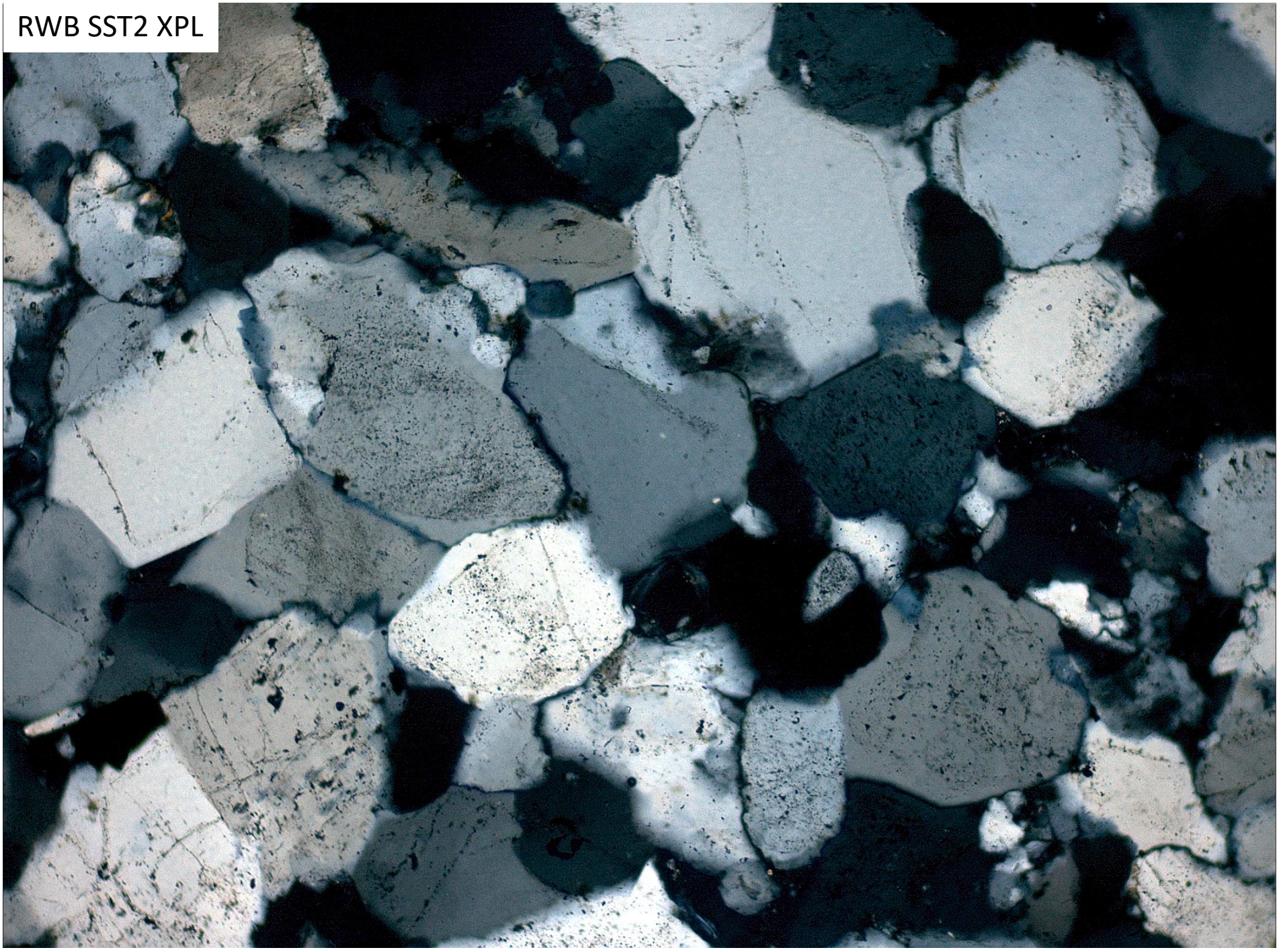
Can you see any evidence of grain faceting*?

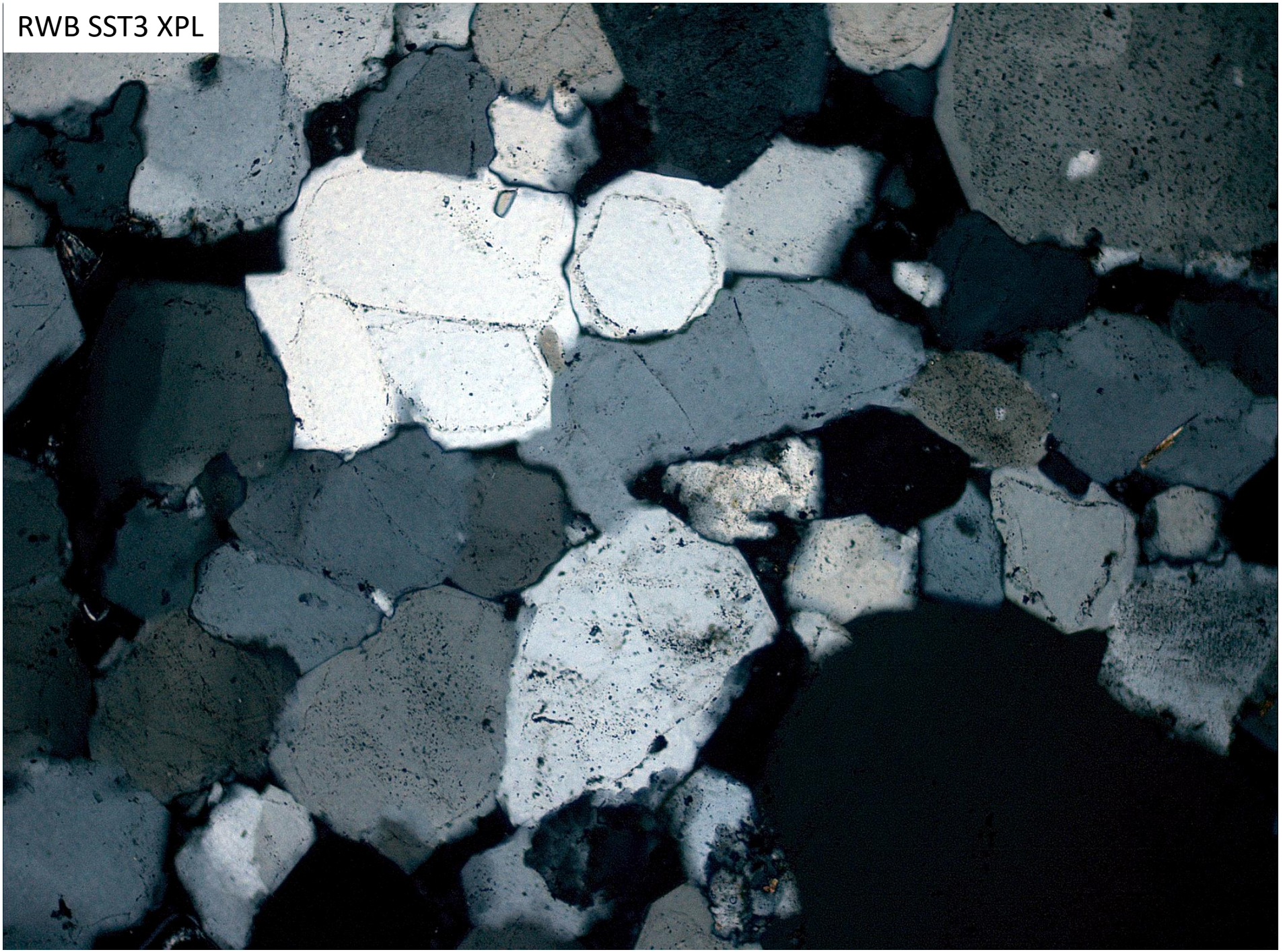
What is the porosity after cementation?

Can you assess the compositional maturity of the sample?

**This is where a rounded grain re-develops planar crystal faces and angular corners due to overgrowth by cement.*


RWB SST1 XPL


RWB SST2 XPL


RWB SST3 XPL

Next, we will look at the carbonate rock. This is **slide 10** back at base, if you wish to investigate

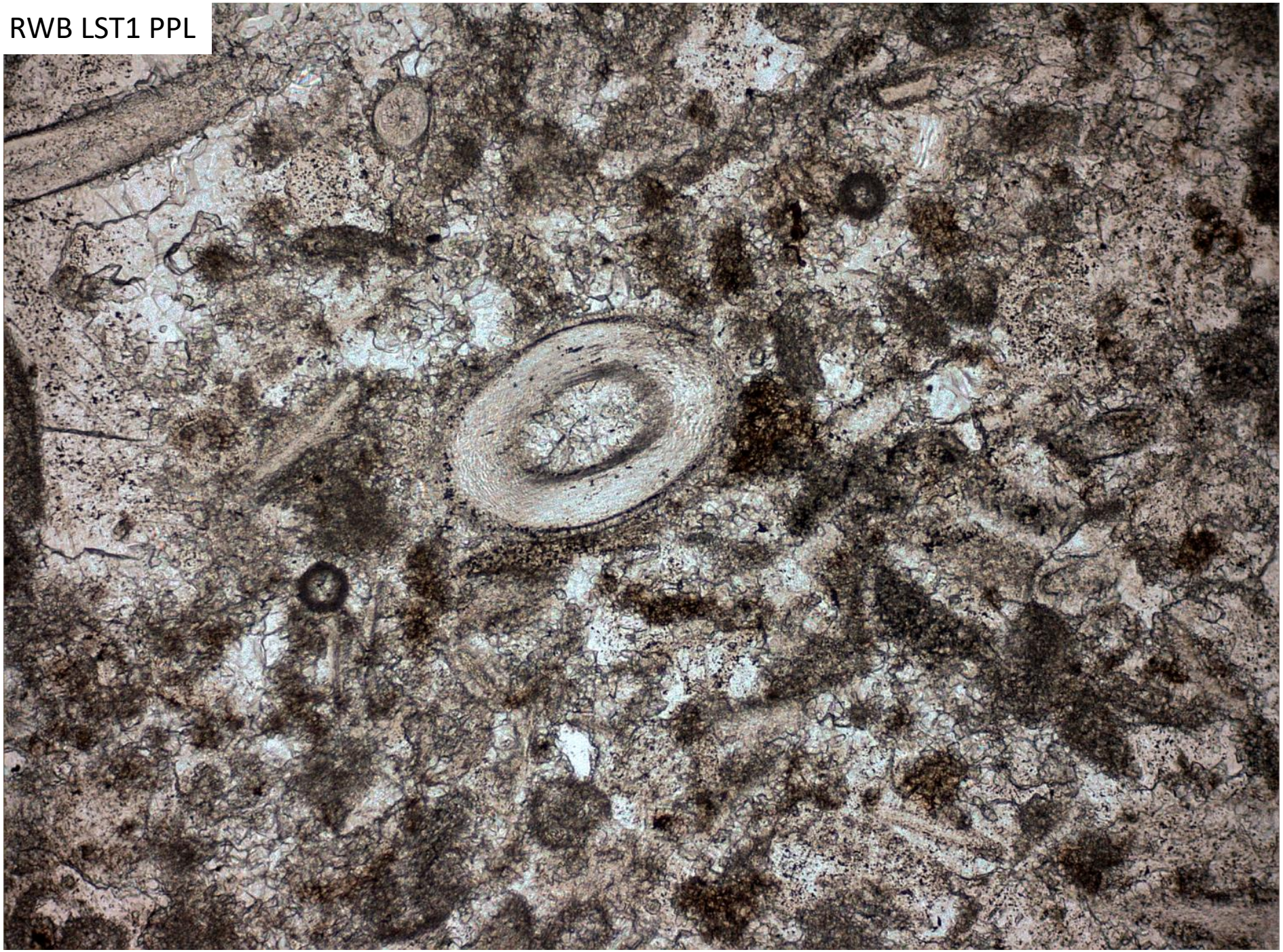
Things to look for:

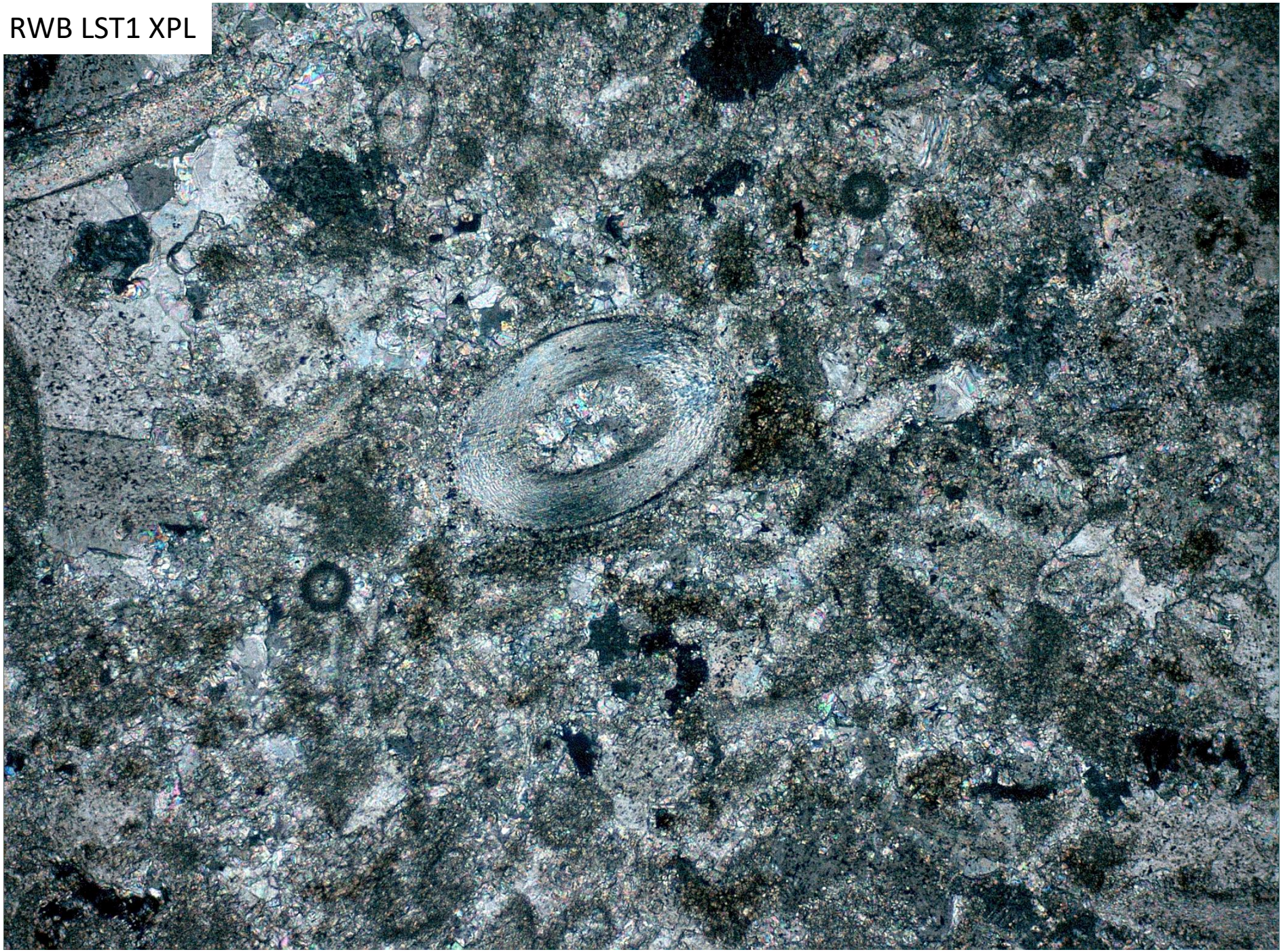
Any evidence of fossils, in particular, any specific types, such as bivalves, brachiopods, echinoids, foraminifera, gastropods …

Any evidence for dissolution and replacement?

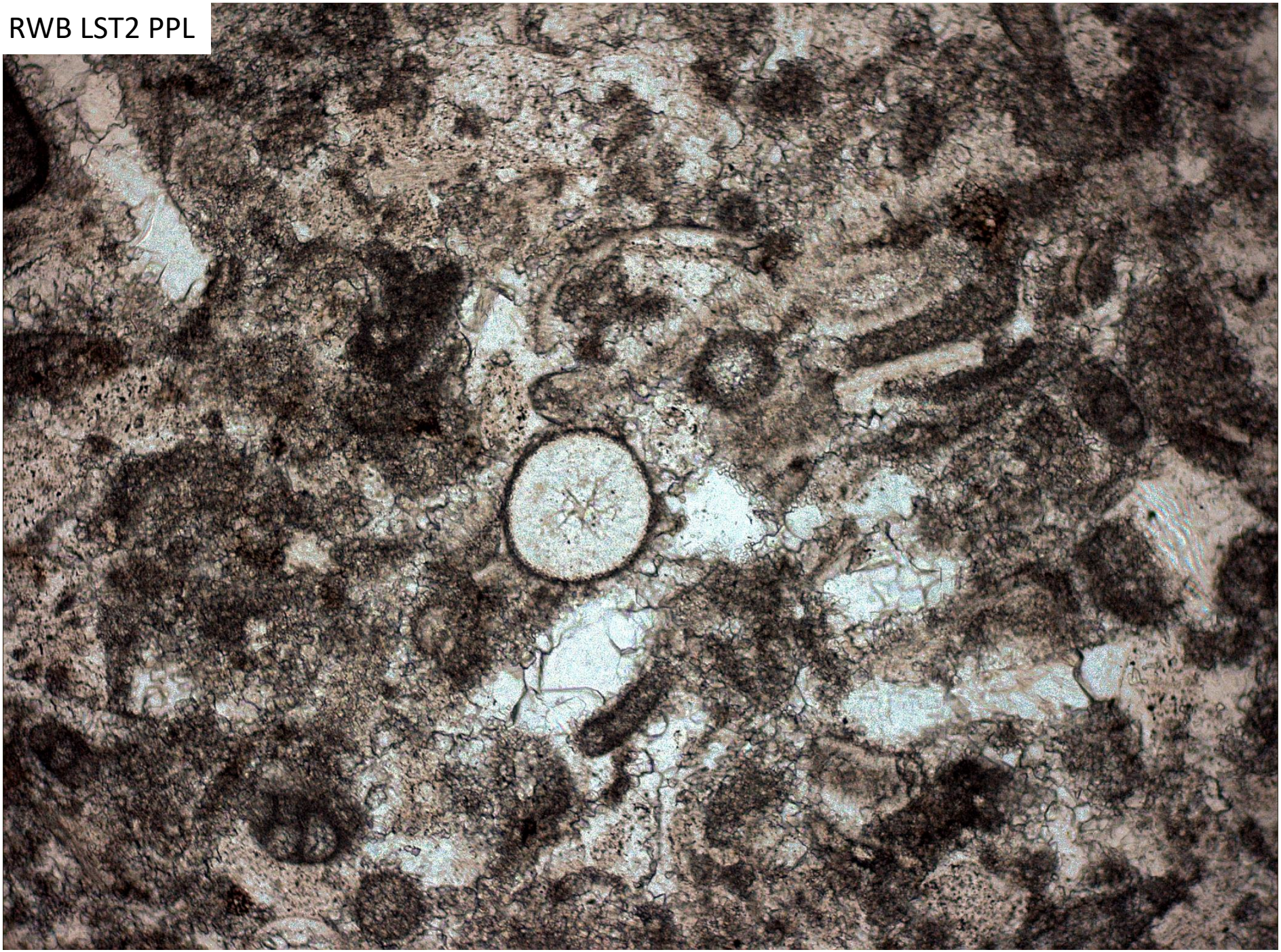
Any *geopetal* structures that could infer way up?

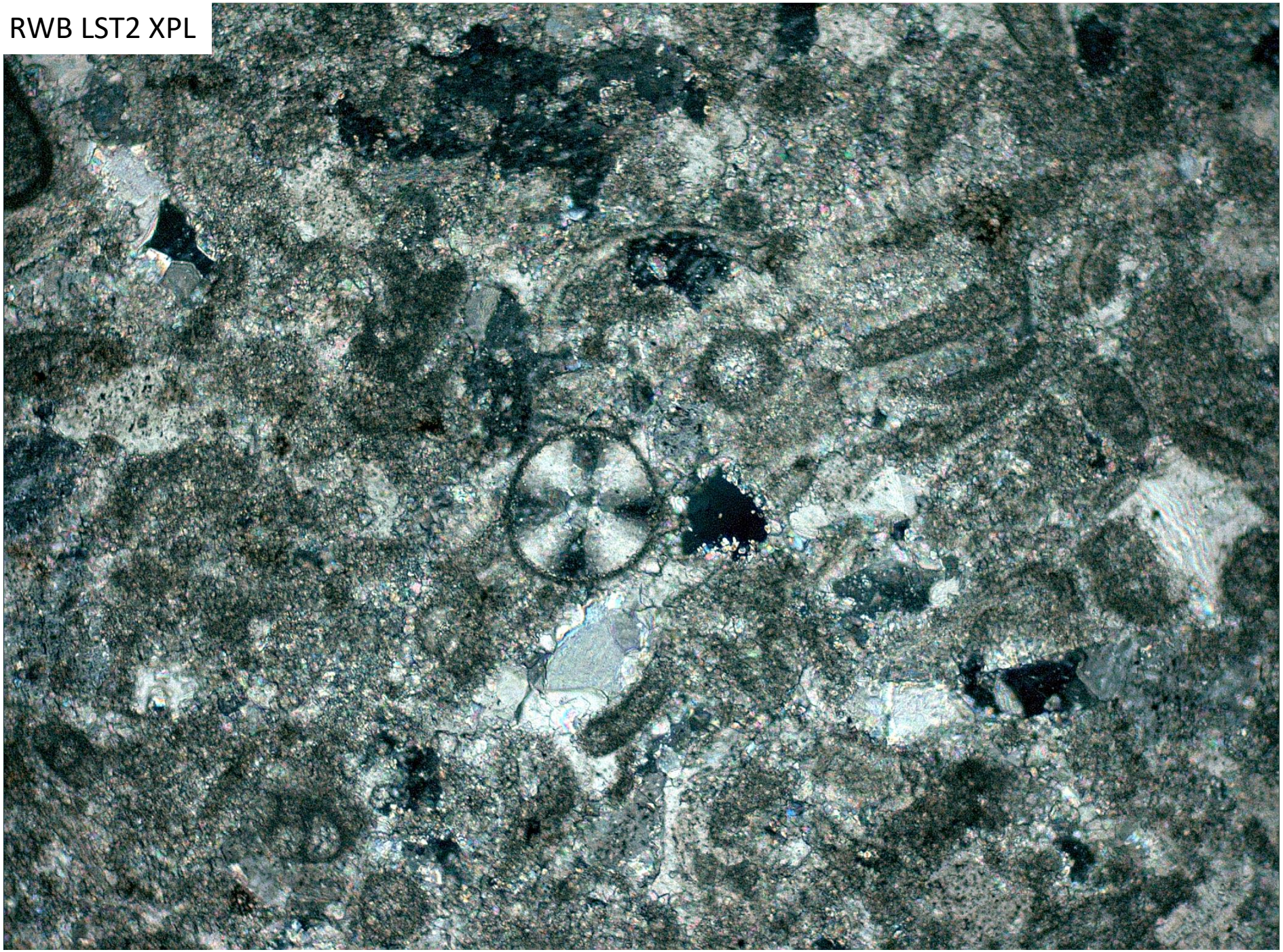
Any chemical precipitates – *sparite* calcite or *ooids?*

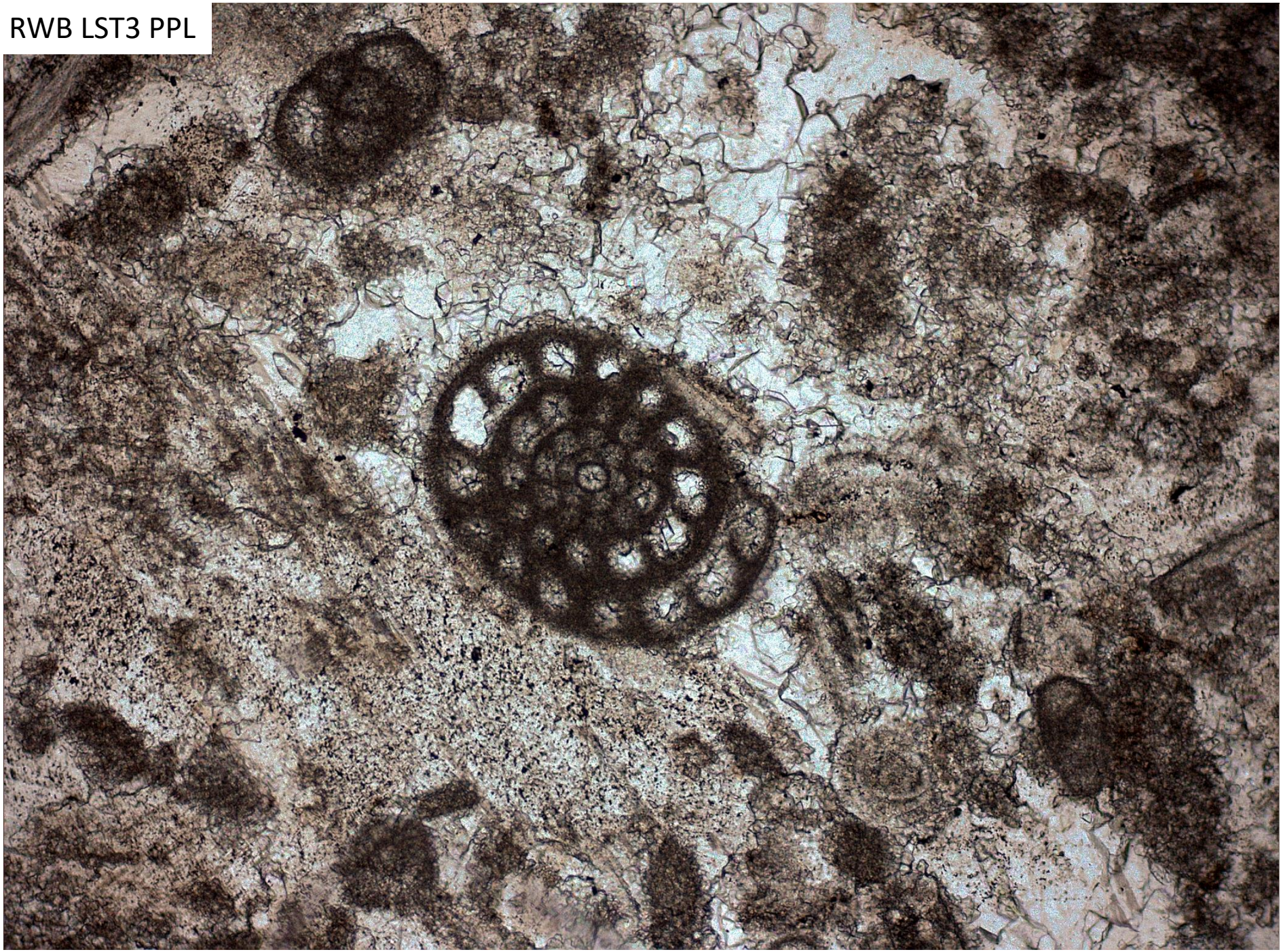

RWB LST1 PPL


RWB LST1 XPL

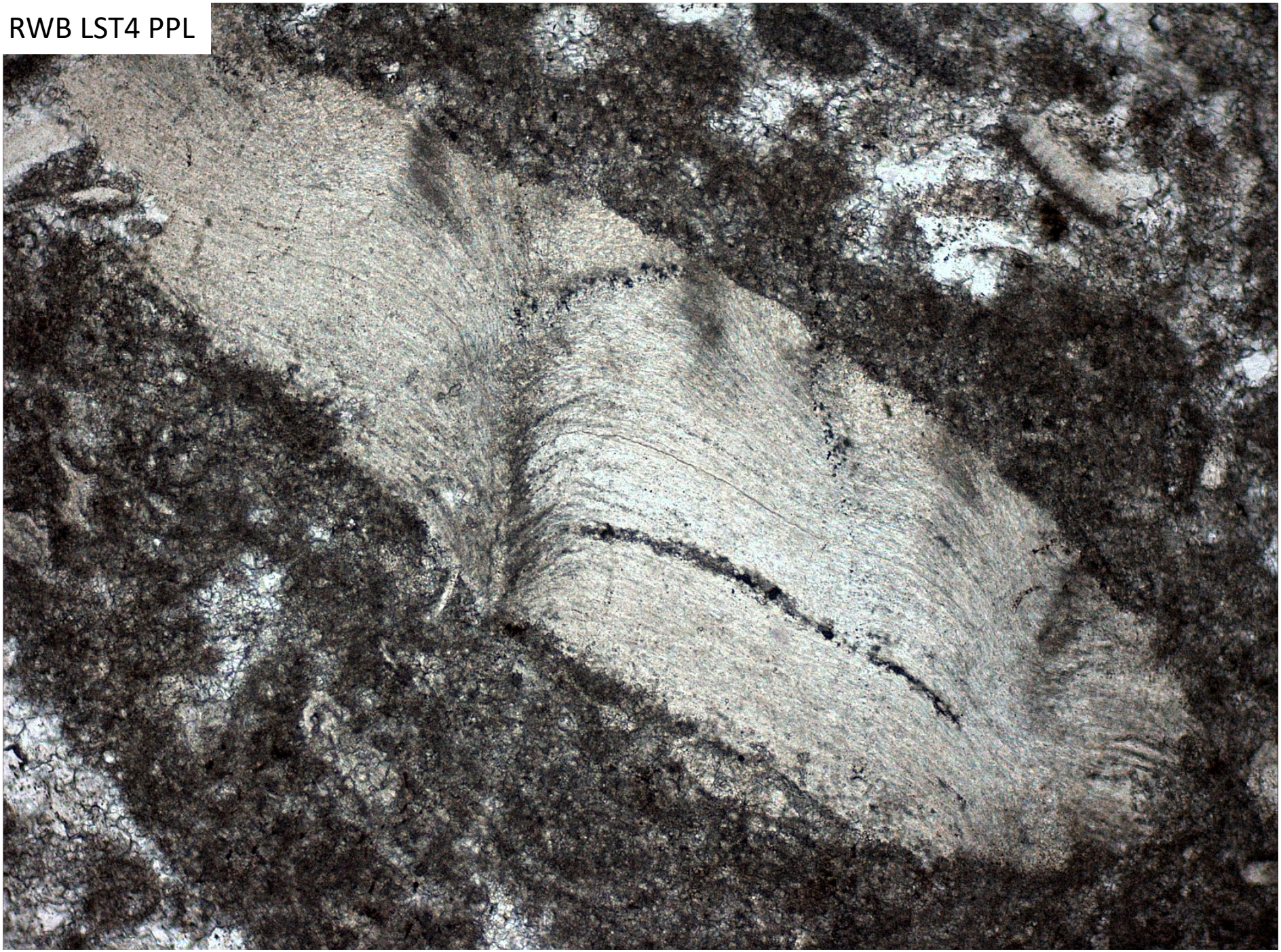
RWB LST2 PPL

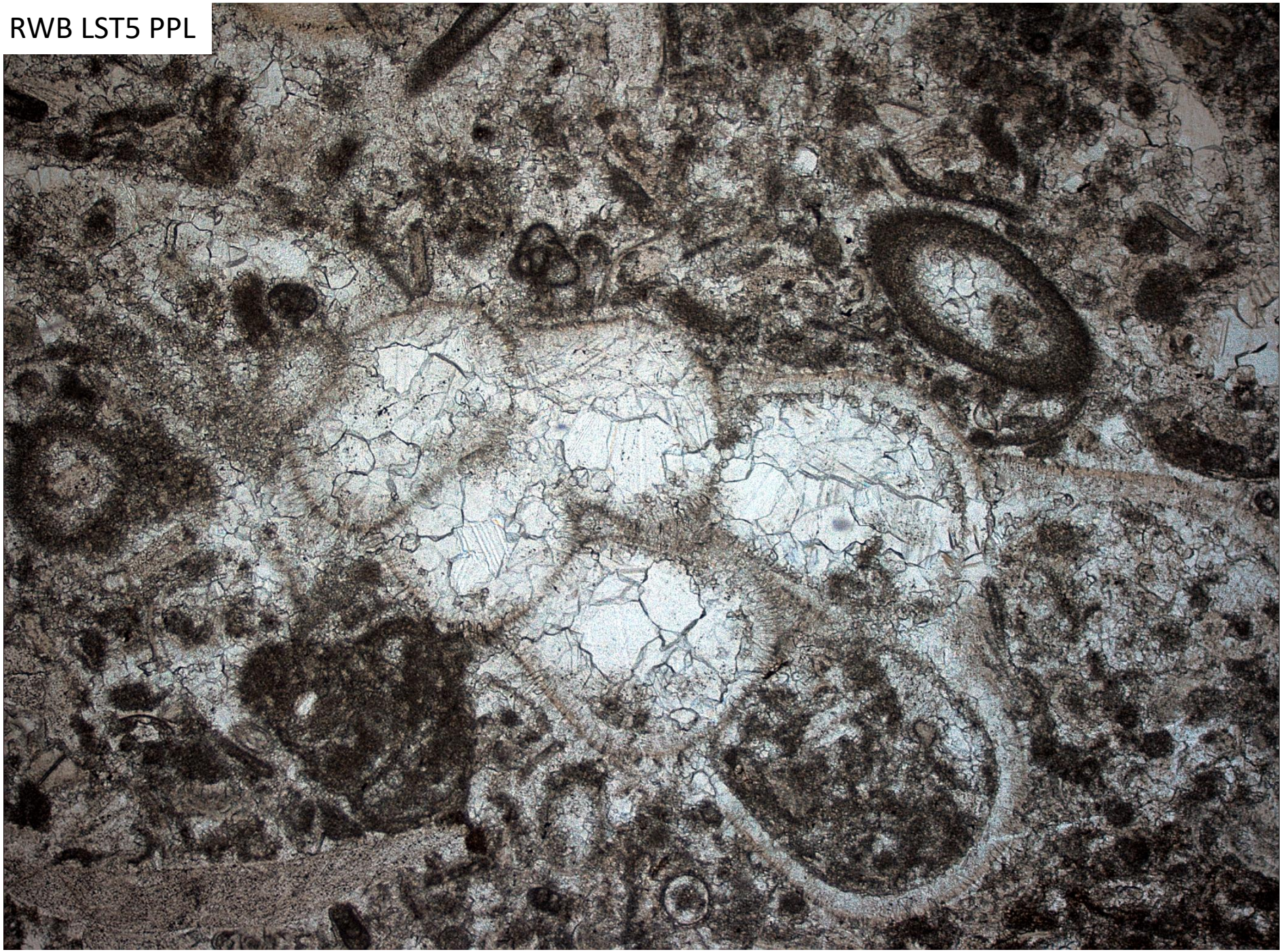


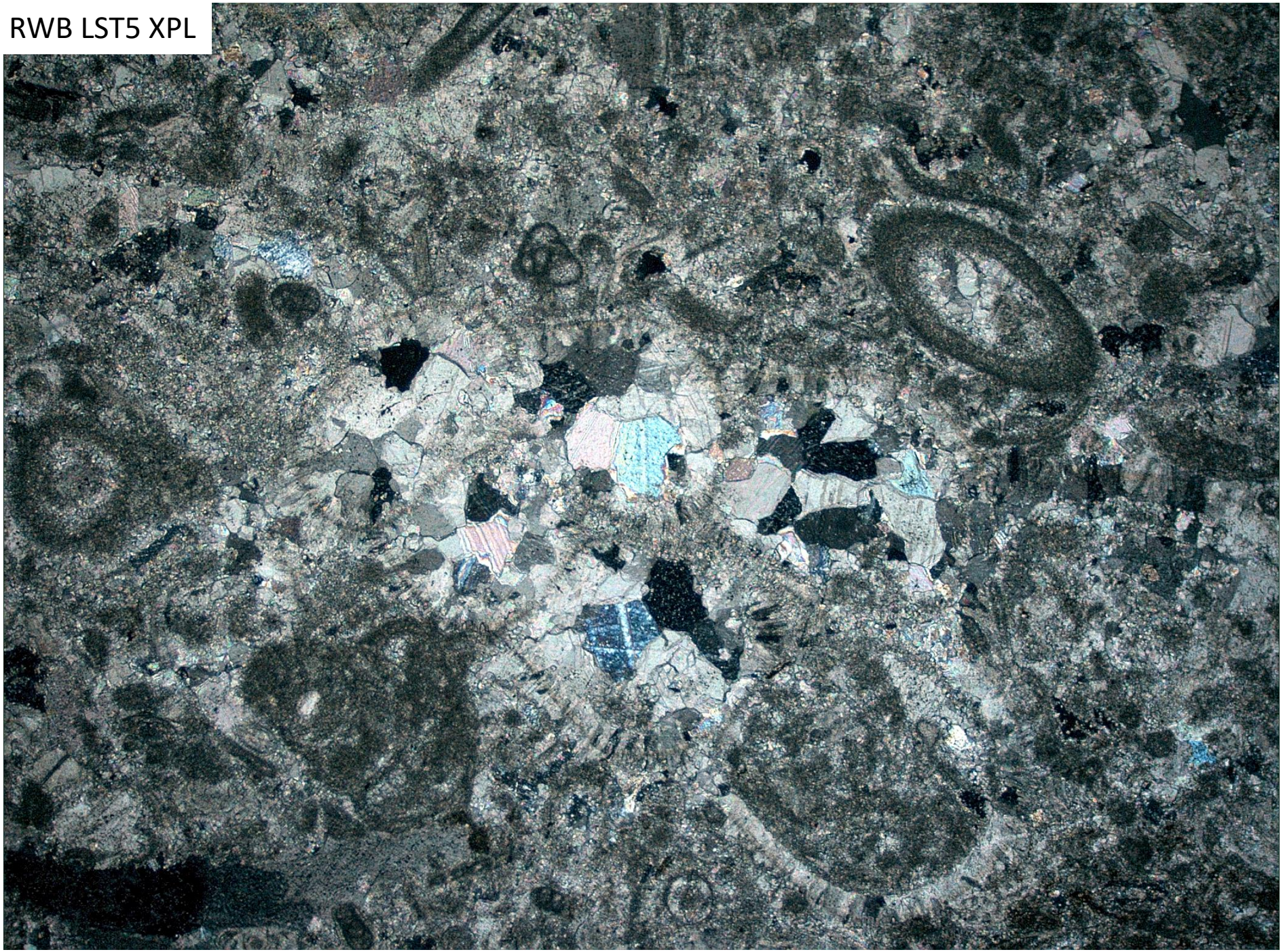

RWB LST2 XPL

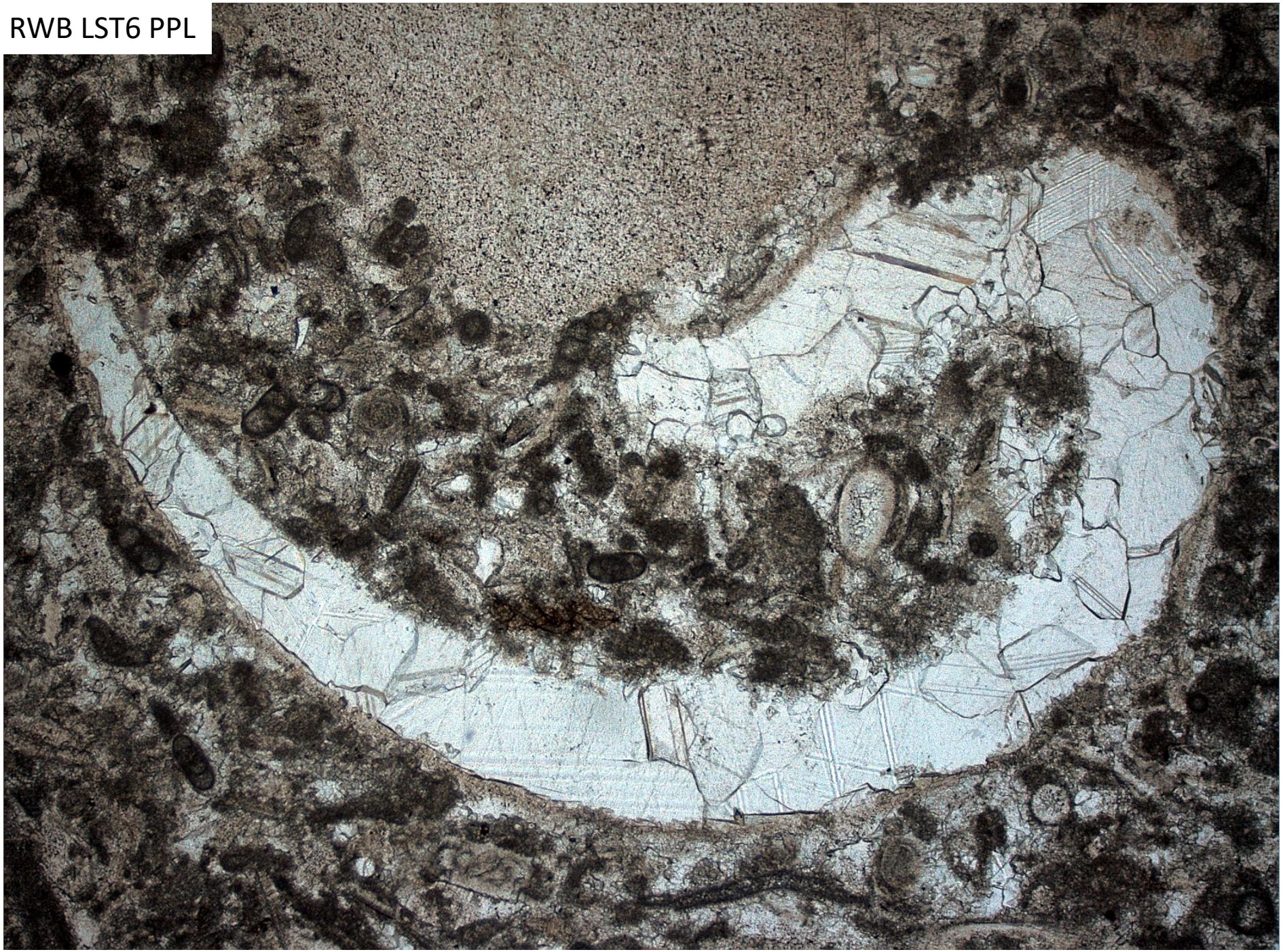

RWB LST3 PPL

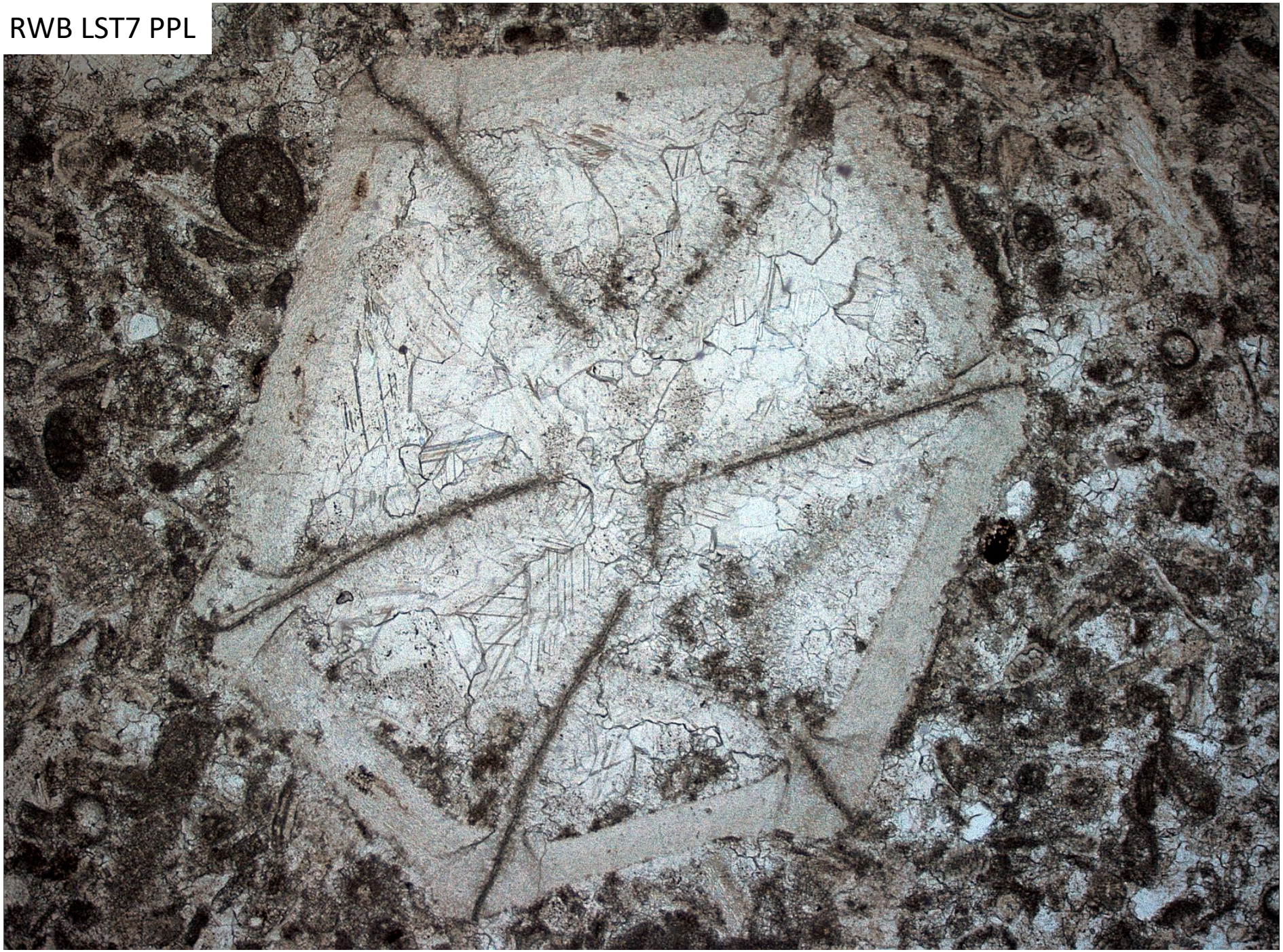
RWB LST4 PPL

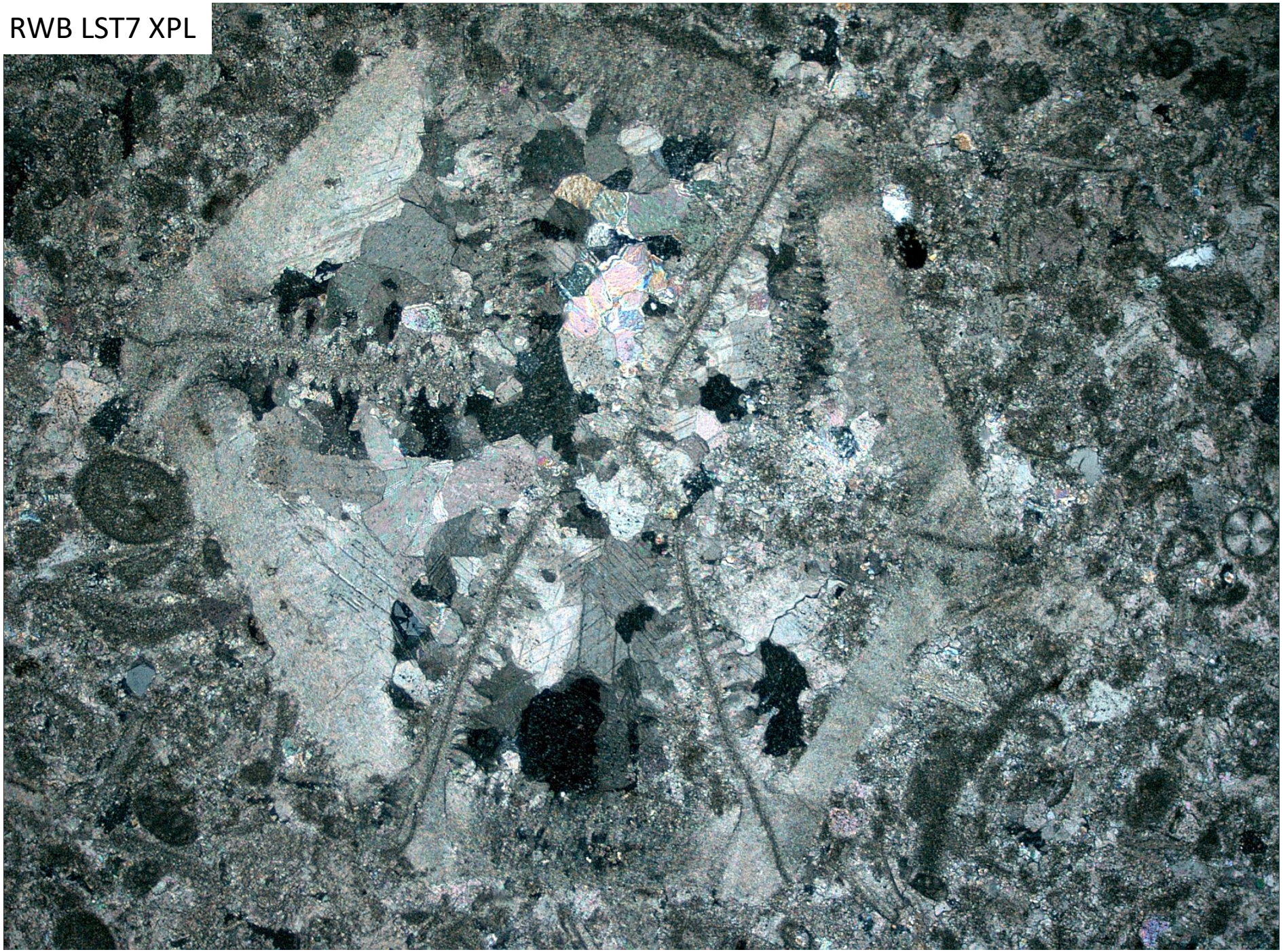



RWB LST5 PPL


RWB LST5 XPL


RWB LST6 PPL


RWB LST7 PPL


RWB LST7 XPL