

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.



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# Exercise: Llanddwyn Island

## Pillow lavas and Mélange: Precambrian rocks of the Gwna Group

# Llanddwyn Island: Background

- Llanddwyn Island contains some of the older rocks of Anglesey, which are part of the Precambrian Gwna (pronounced Goo-na) Group.
- Whilst some of the rocks are quite recognisable, even today, others have suffered intense tectonic deformation and reworking. This has mixed slivers of rocks together, at scales from the hundreds of metres scale, all the way down to the thin section scale.
- Our task will be to work our way through these outcrops, which start relatively accessibly and will later become an exercise in how to assess, and deal with, geological complexity.
- As noted in the handout, we hope to gain access to the beach, where the first outcrop is, and from there reach the Island. The far outcrops are not easily accessible but we hope to relay a video link.

# Outcrop 1

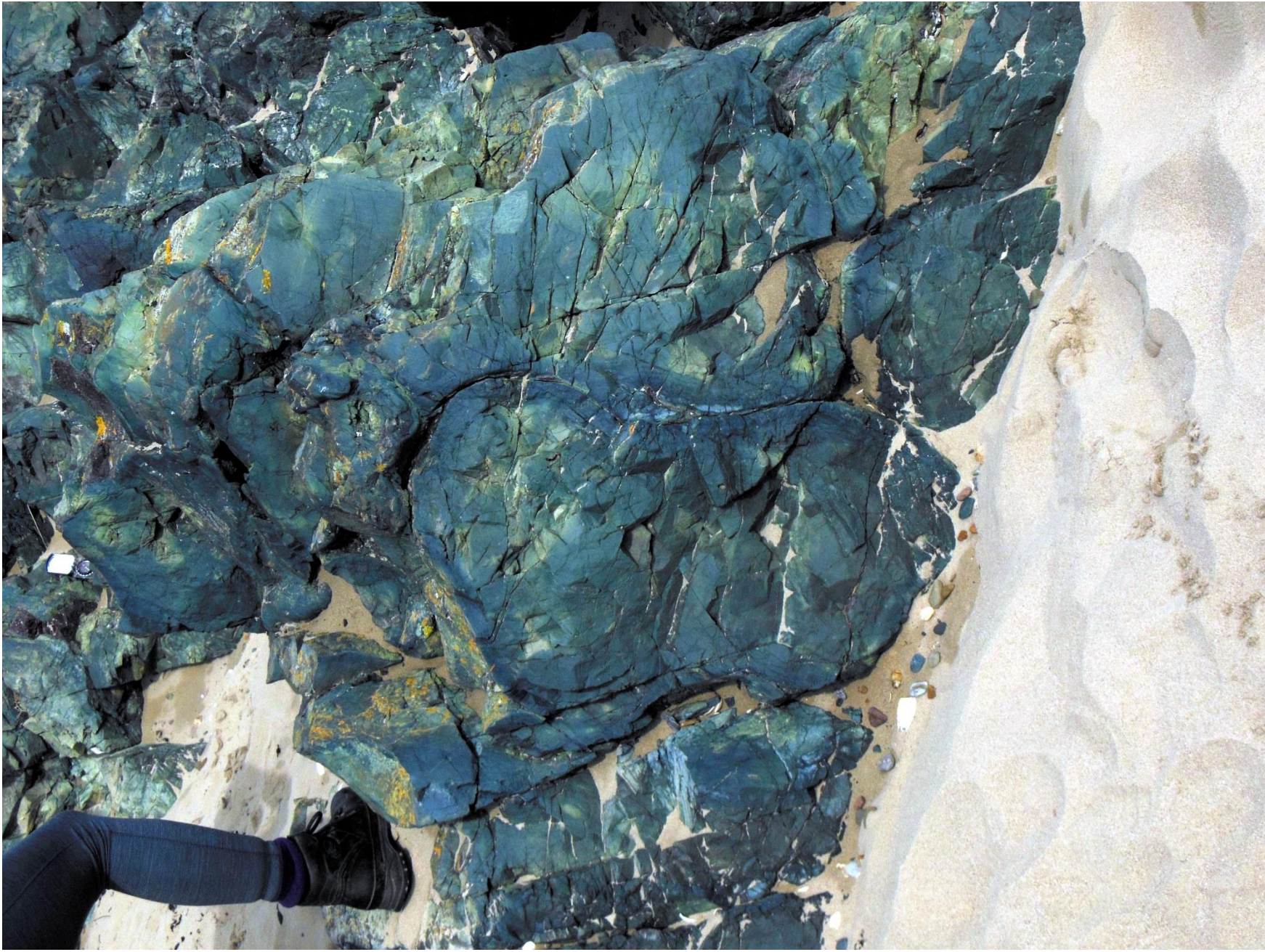
This is the first outcrop that is encountered as you go along the beach. If you have seen this kind of rock before you may recognise it from the photograph. Have a look at the image. Can you see variations in colouration? What kind of structures are these colours mapping out within the rock?

Particularly evident colours here are pistachio nut green ①, indicative of ***epidote***, and blue-grey-green ②, indicative of ***chlorite***. What do these minerals suggest in terms of metamorphic conditions?

*(Hint: An interpreted version is available if you need a hint).*

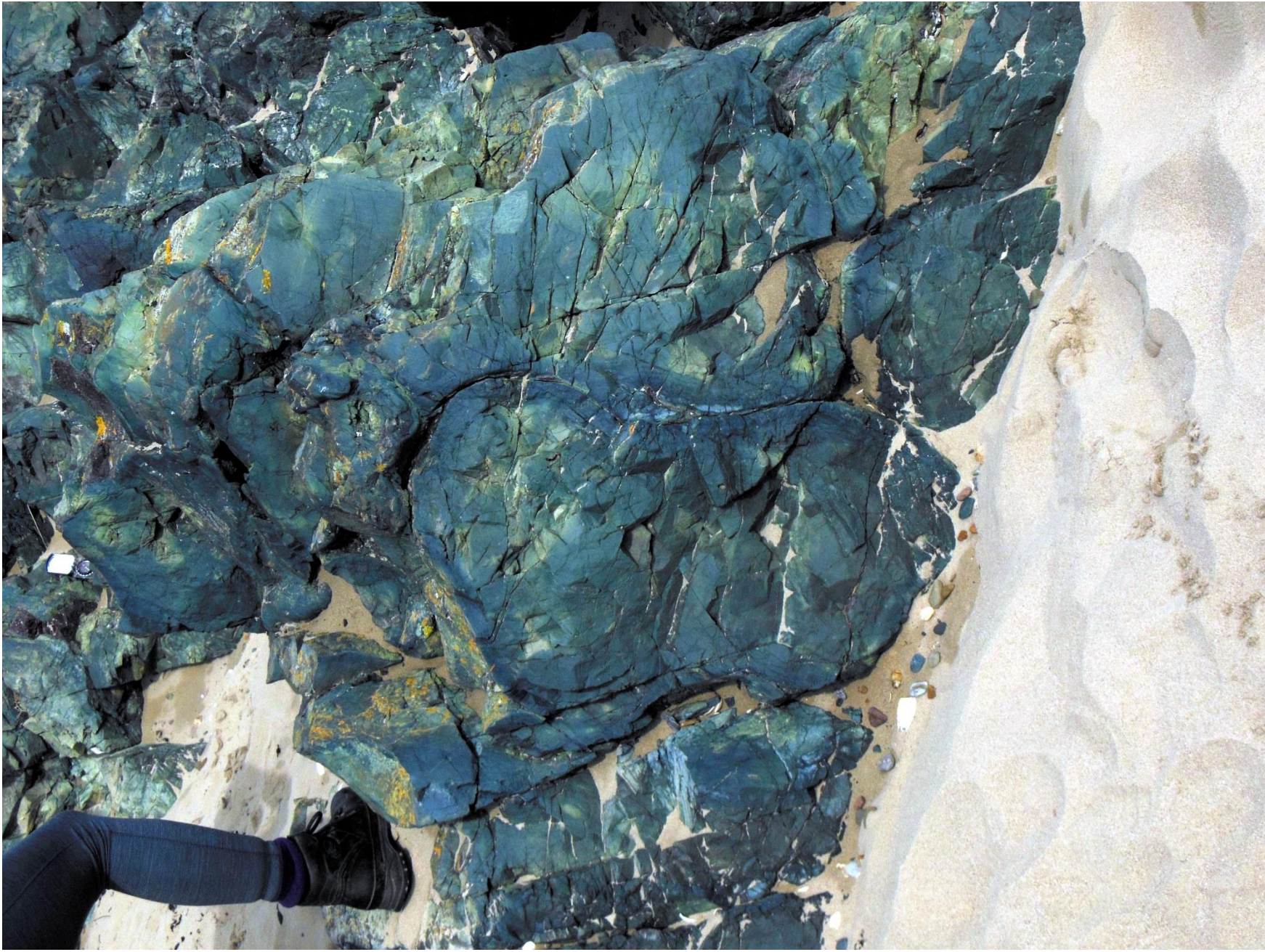


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# Outcrop 2, the island

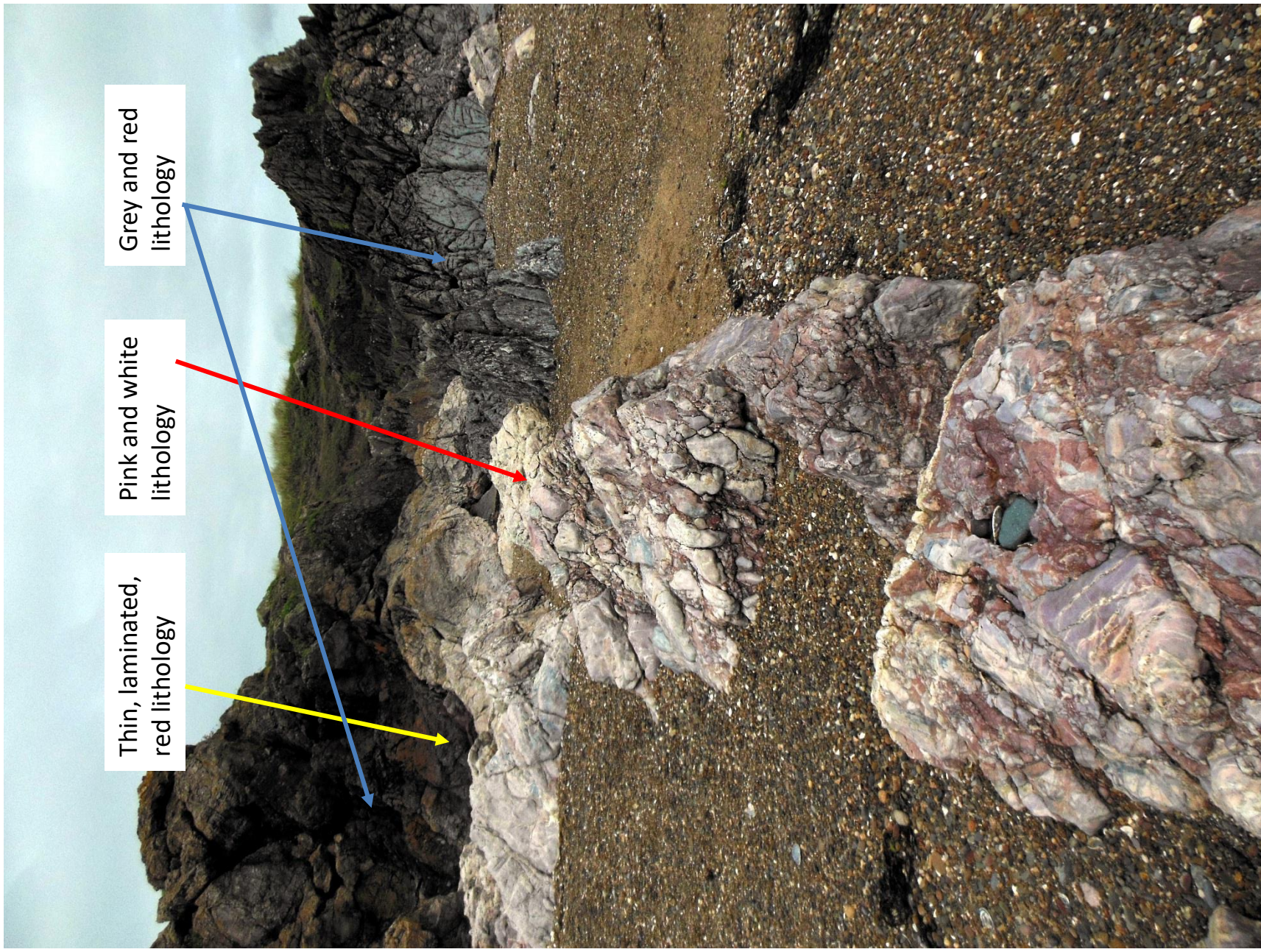
On the island itself we will look at some outcrops between the two lighthouses.

The beach is not really accessible, but we do have a selection of material samples, and we also hope to deploy the Relay for transmission between iPads.

- Have a look at the materials we have available. Describe the three country rock lithologies present
- Using the relay it may be possible to investigate a fourth, discordant unit. Unfortunately we were not allowed to sample it due to the SSSI status.
  - Have a look at the associated photograph to get field relations



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# Outcrop 2, part 2

We also have some detailed field photographs of outcrops and high-resolution scans of the hand specimens from this area. In addition to hand samples of the pink-and-white lithology and the grey-and-purple lithology, the scans may help you to consider some detailed analysis.

The images or hand specimens should let you detect some signs of deformation in these rocks. Was that deformation brittle or ductile?

From working through these same specimens, can you decide if deformation seems to have been a single event or a continuous process? What is the evidence either way? This may not be a simple question in some cases!







Pink and white lithology, polished pebbles (available as hand specimens)



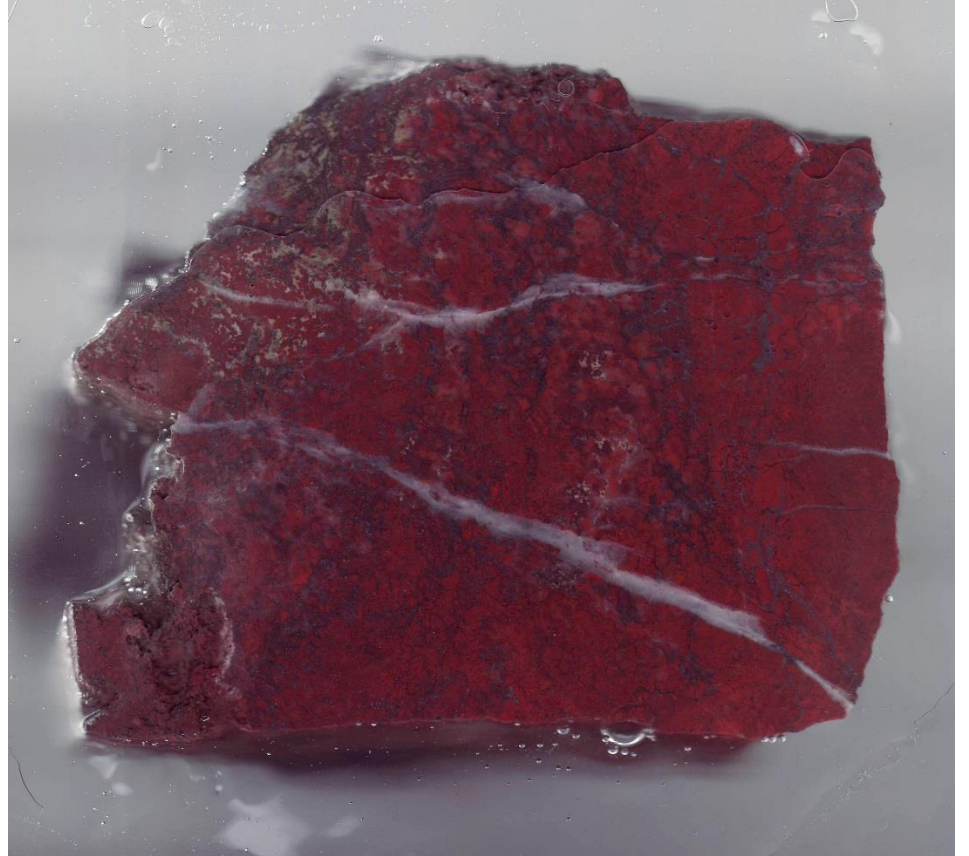
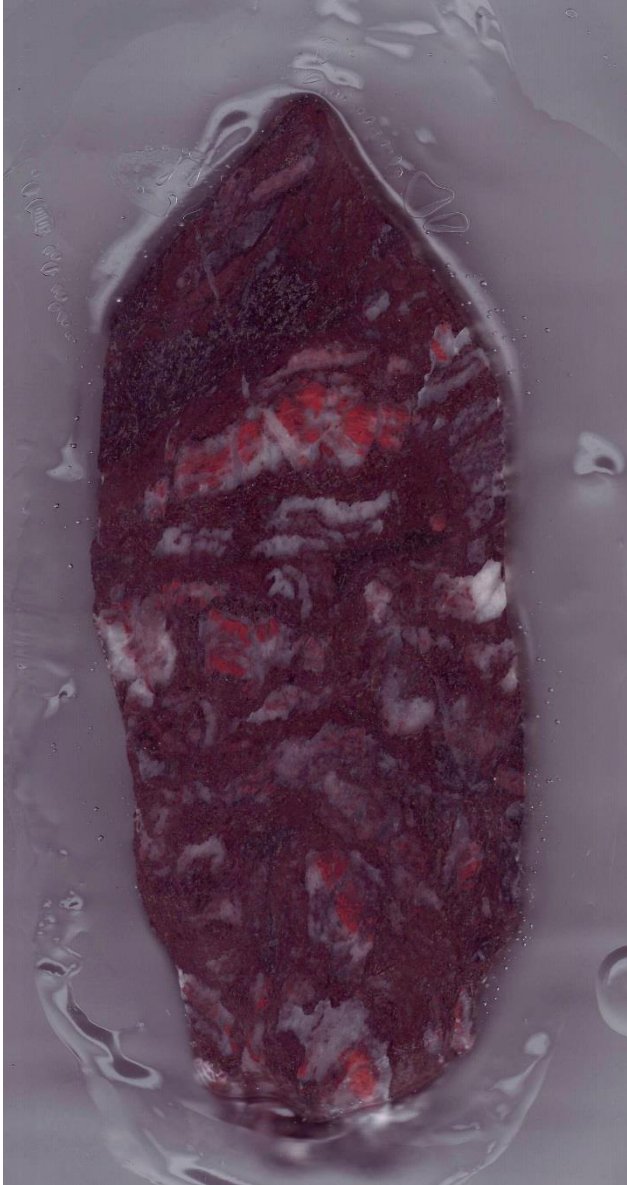


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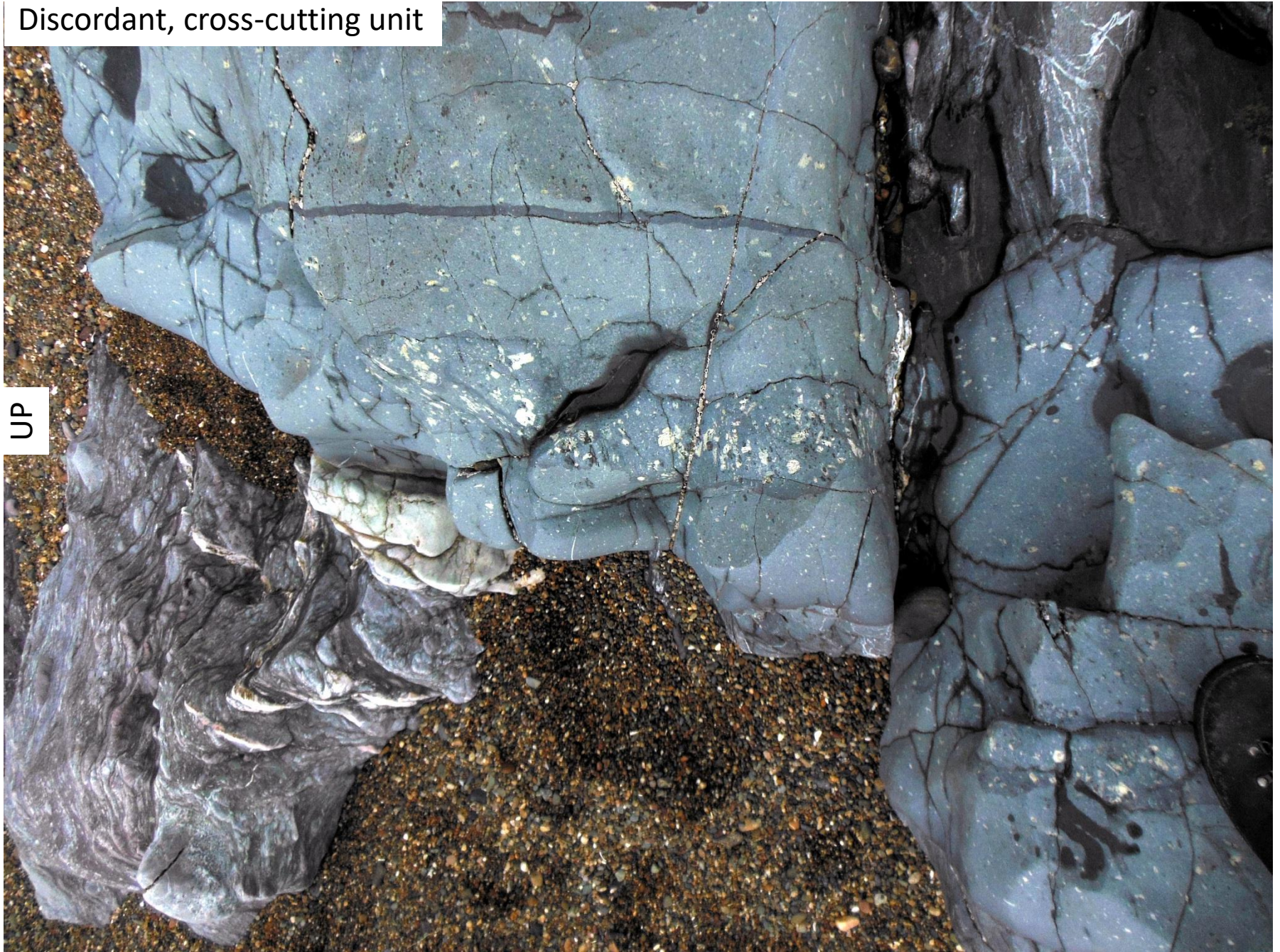
Carbonatic lithology (left), and hard red chert (found as blocks),  
both available as hand specimens





Discordant, cross-cutting unit

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# Consideration of context

What we have seen here is a mixture of complexly-deformed lithologies.

Take some time to consider where we might see all of these lithologies together: pillow lavas, red cherts, carbonate sediments and clastic sediments

Then consider how we might be able to deform them so intensely.

The tectonics of Anglesey include a lot involvement with subduction processes. Are these rocks likely to have initially formed on the subducting or overriding plate, or both?

How do you think they could have been physically mixed together? Can you think of an environment linked to the tectonics where this could occur? Write down your thoughts and discuss with someone.