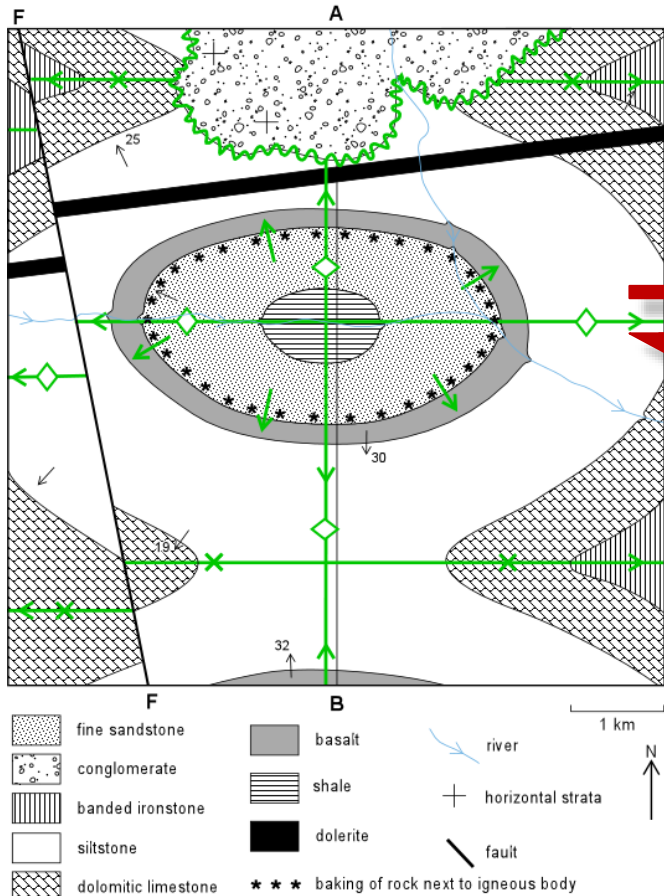


Flipping problem maps: bane or benison?

GEOLOGICAL HISTORY



- Deposition of a series of conformable sedimentary units, starting with shale, then the fine sandstone, emplacement of a basaltic lava flow, then deposition of the siltstone, dolomitic limestone, and banded ironstone
- Folding of this entire sequence during a regional deformation event
- Uplift and erosion of the entire area
- Deposition of the conglomerate on the eroded strata
- Intrusion of the dolerite dyke
- Brittle faulting to form the fault F-F
- Uplift and erosion to form the present landscape

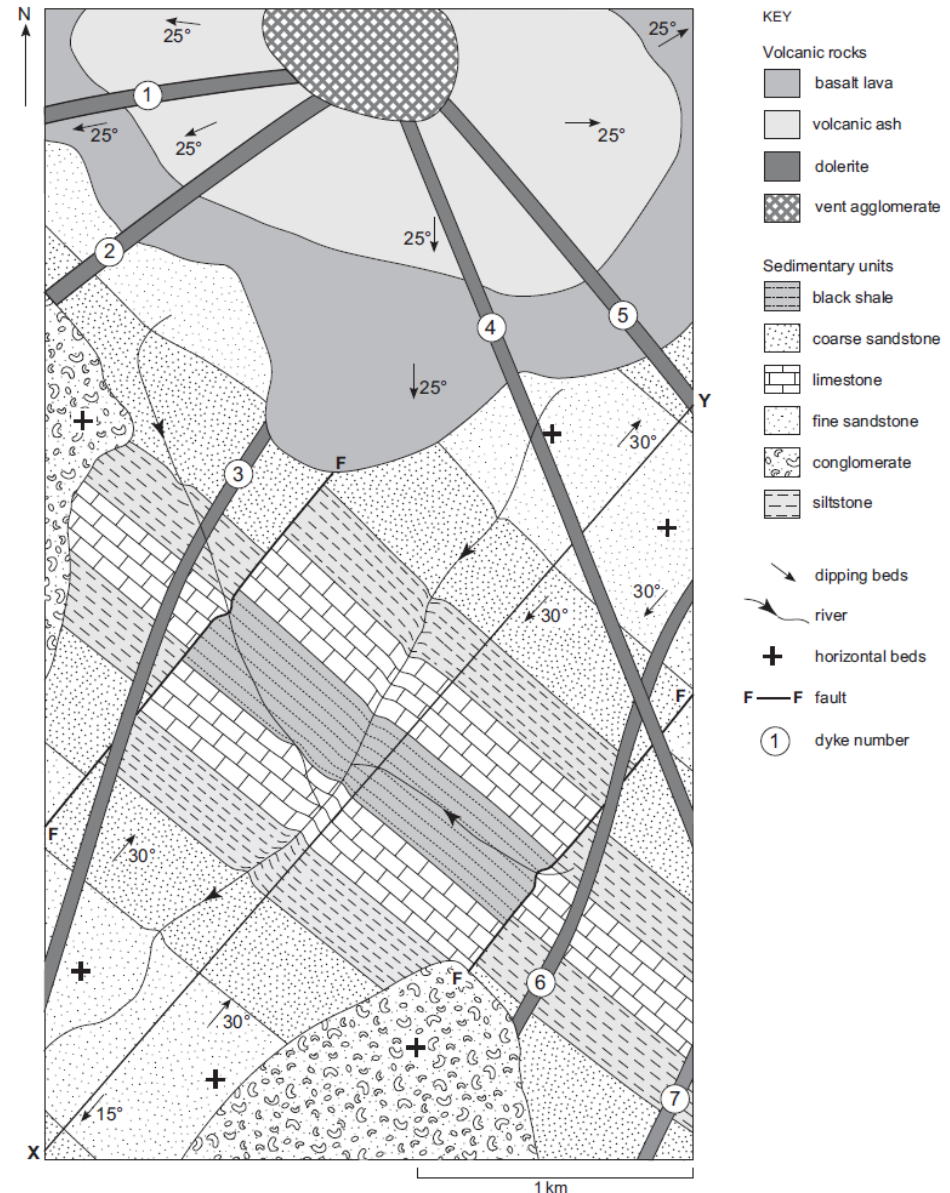
Problem maps: what and why?

What are they?

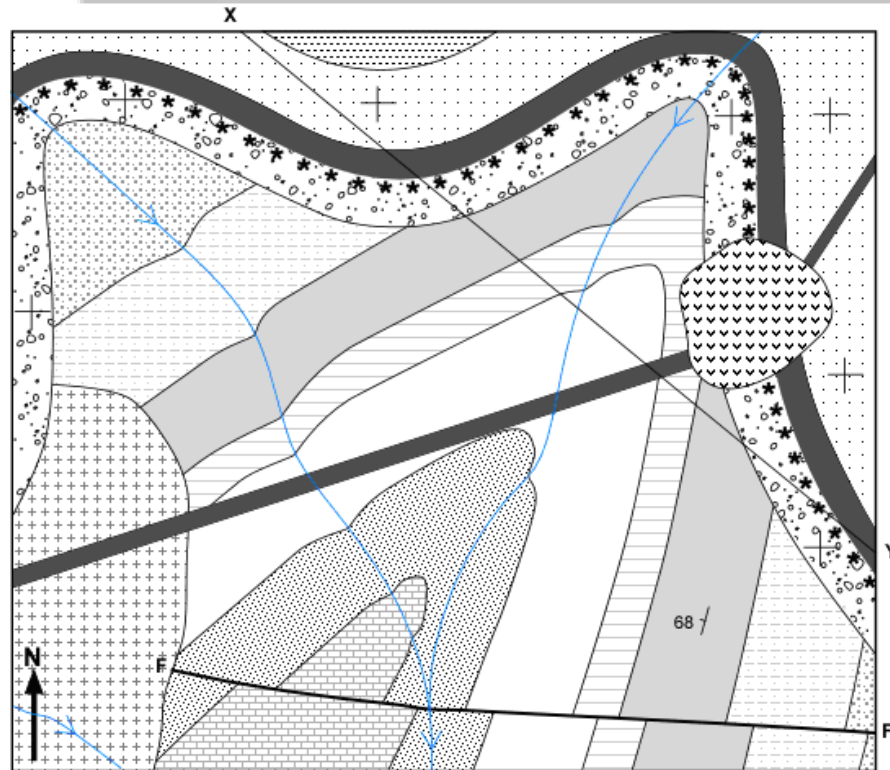
- Geological maps for students to (mis)interpret
- Generally simple
- Often fictional

What's the point?

- Test specific map skills
- Test high-level spatial skills (e.g. subsurface visualisation)
- Test broad geological knowledge
- Practise synthesis of diverse data and concepts

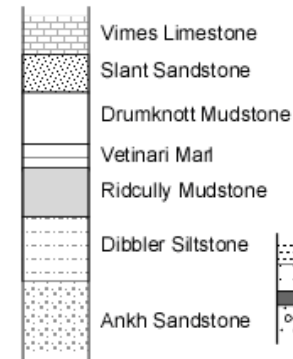


Problem maps: example



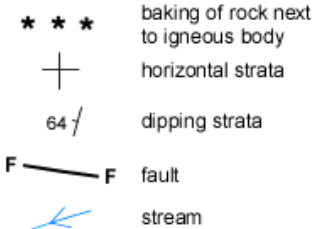
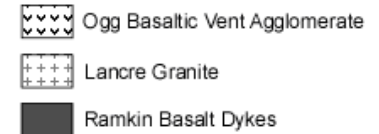
Key

Sedimentary rocks

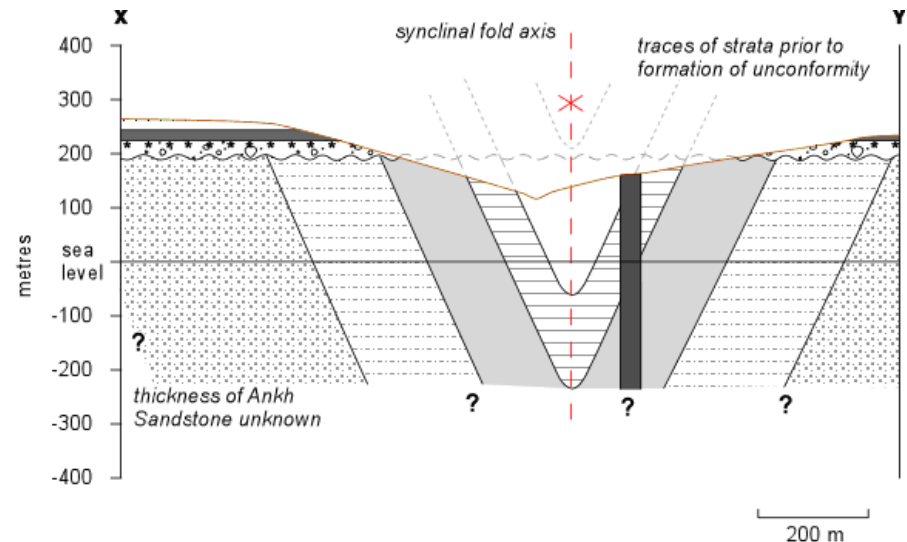


(stratigraphic columns not to scale)

Igneous rocks



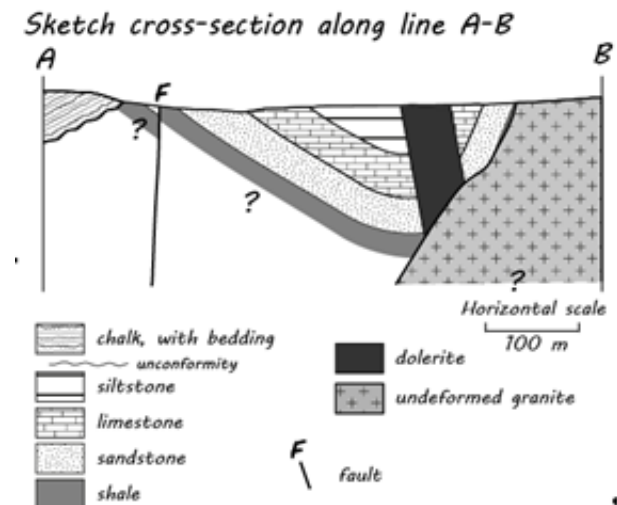
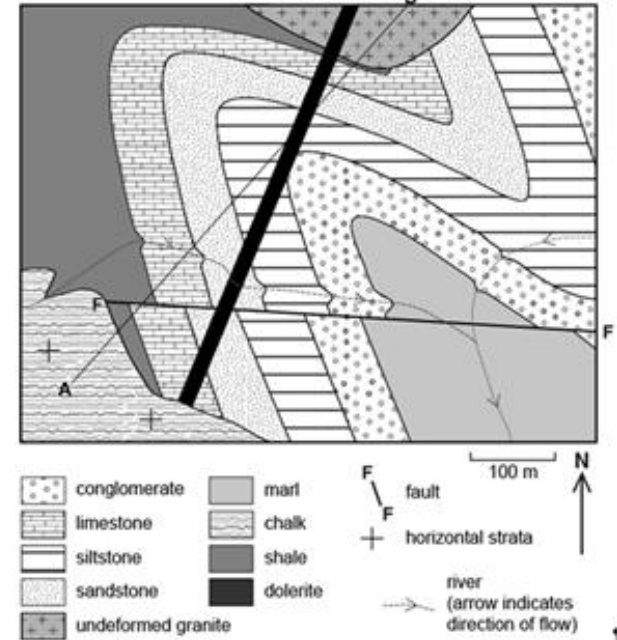
- Deduce geological history
- Which side of fault is downthrown?
- Draw geological cross-section



Problem maps: the problem

Why change what ain't broke?

- Core geology module rewrite
- Assignments: summative → formative
- Criterion marking to LOs, not 'points'
- Move towards more recyclable Qs...
- ...but make plagiarism difficult
- Less time on map skills in revised module



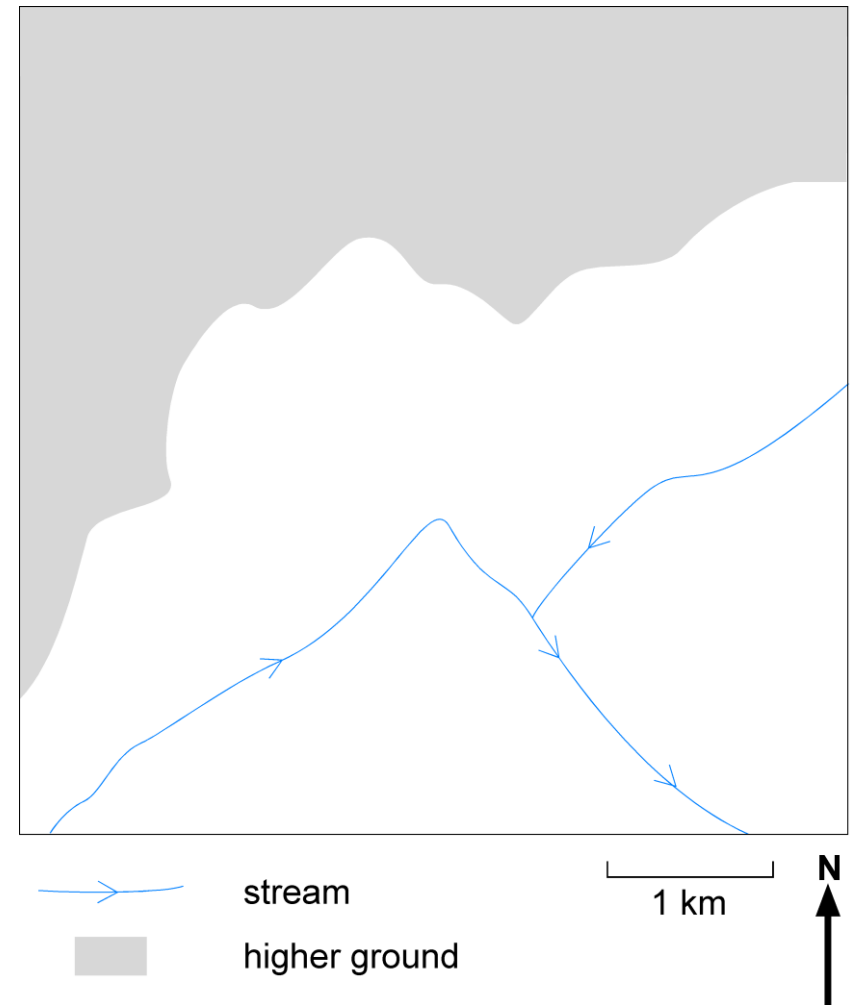
Problem maps: the 'solution'

FLIPPED MAP

- Provide a geological history
- Provide a very simple **base map**
- Ask students to draw a map consistent with the given geological history (with copious instructions & guidance)

Benefits:

- No need for new map each year
- Deeper learning for students?
'Productive failure' (Kapur, 2008)
- Infinite number of 'right' answers



Simple base map as guide for students

Flipped maps: support for students

Offline resources

- 2 screencasts on general map interpretation, section construction
- 'Maplets and columnettes'



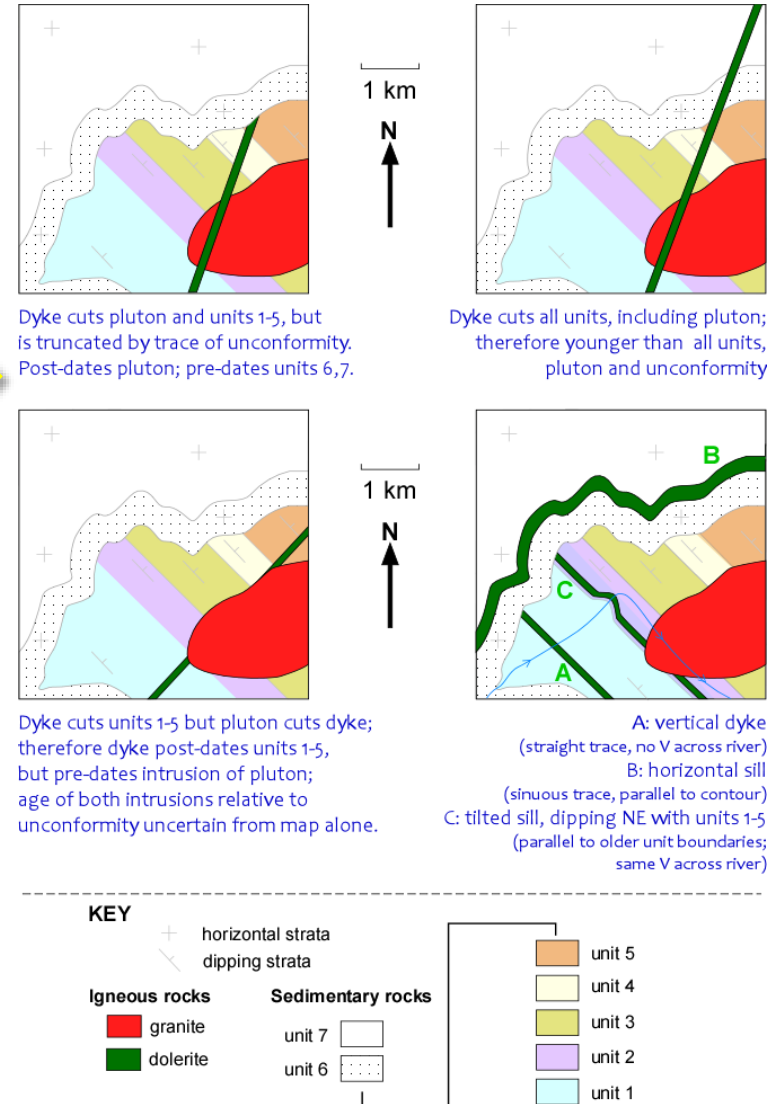
Online tutorial

2 online sessions run by tutors on map interpretation

Online forums

One online forum dedicated to the 'Maps and landscape' topic

Series of 'maplets' on intrusions for tutors to provide to students as feedback on marked assignments



3. Dyke cutting strata and/or pluton

Flipped maps: comments & reaction

“I've submitted TMA 02 - but my map's really rubbish - I think I've got a lot wrong! Will be interested to see what it should have looked like.” **Student comment, reported by tutor, 2014**

“I realise that there are lots of 'possible' answers to the map question, but are we allowed to show them one of the many possibles?” **OU Tutor, 2014**

“While there is a fair amount of practice and explanation in the tutorials and course material about how to interpret a geological map, there is little about doing it the other way round.” **OU student, 2016**

“Drawing such maps from scratch may actually promote a deep sense of inadequacy rather than deep learning.” **OU Tutor, 2014**

“This is the frustrating thing, how to help them improve and learn from mistakes. You almost need a series of maplets ...” **OU Tutor, 2014**

“...it would be easier to copy/paste in the answer from the mark scheme and point out the bits missed or what is wrong. However, I've refrained from doing this as we are told not to provide the answers from the mark scheme” **OU Tutor, 2014**

“Incidentally the map solutions were generally more plausible in my group this year.” **OU Tutor, 2016**

Flipped maps: your turn!

Geological history

1. Deposition of 4 marine sedimentary units
2. Whole series tilted NE; uplift and erosion of area
3. Intrusion of a granodiorite pluton into the tilted units
4. E-W extension of area, accompanied by formation of steep normal faults
5. Subsidence and deposition of a single unit of marine limestone
6. Gentle uplift, emergence above sea level, erosion to form the present landscape.

Draw a geological sketch map that is consistent with this history...

...and which would allow this geological history to be deduced from the evidence on the map