



Geological structures exposed.

Deformation history

Narrator:

So far we have separated out kinematics from structural chronology but in the most useful outcrops there is abundant evidence for deciphering both aspects of the deformation history.

Nigel:

Well we've moved over to Perthshire to have a look at folding in the Upper Dalradian rocks. Here's a very nice example and the first thing that strikes me is that what we're looking at is an asymmetric fold pair so, obviously, using the information you've given me recently I would like to establish the vergence direction. So, long limb, short limb to rotate from the long to the short limb I rotate in *that* sense, so that is the anticlockwise movement and the vergence direction must be to the north-west.

John:

Using the upper arrow of the rotation couple.

Nigel:

Using the upper arrow.

John:

Yep. Splendid, we'll make a Structure Geologist out of you yet.

Nigel:

Thank you, John.

John:

But you have also noticed that there are some smaller folds in the fine-grained rocks underneath the one that you've just been looking at and some of them, this one in particular here, form asymmetric fold pairs, so we could actually start to assess vergence on the individual limbs of the fold that you've just been looking at.

Nigel:

Well that's quite useful 'cos it does demonstrate that you can use folds on a whole range of scales in order to get kinematic information.

John:

Yep, we can and *must* do. Well, this is all very well and, but it's kinematics and we actually came here to collect some information about structural chronology, and for that we need to just look behind me here. Here we've got a bed which has a sharp base and we have quite light coloured coarse-grained material here, which grades as we go in the direction to darker material that is, has a finer grain size. You can tell that because the cleavage is better developed in this side of the bed, it's more widely spaced in this side of the bed. So this is a graded bed, classic graded bed, which is telling that these rocks are younging, they're getting younger in *that* direction, and that direction is upwards to the north-west, so they're the right way up.

Nigel:

And how does that relate to the fold?

John:

Well this is the interesting thing because if we can take that information now and check it as it goes around the fold, so beds on this limb we've just established are younging upwards in that direction. If we take that information around the fold, by the time we get to the axial plane

in the fold, that direction, the direction in which these beds are getting younger, is now pointing downwards.

Nigel:

So it's the downward facing fold.

John:

This is a fold where we are getting, using younger rocks as we pass *down* the axial plane, downward facing. And as we know, that means that we must have more than one episode of deformation in order to generate such structures.