The Geological record of environmental change

Utah: An incised valley at Tuscher Canyon

Voice Over

Steve has travelled south to find evidence for another sequence boundary higher up in the stratigraphy.

Steve Flint

I'm in Tuscher Canyon in the southern Book Cliffs. The theme here is erosion surfaces, sequence boundaries, incise valley fills and distributory channels. In sequence stratigraphy it's critical to make the correct distinction between distributory channels like we saw in the panther tongue, and incise valley fills like John has just demonstrated at Woodside. Behind me we have shoreface deposits cut by spectacular erosion surface cutting down to the right. Is that a distributory channel or is an incise valley? Let's go and look.

This is a shoreface sandstone that underlies the incision surface we saw from the other side of the valley, and you can make out the low angle hummocky cross-stratification. This indicates deposition in a lower shoreface environment and water depth of about 20 metres, so given how water depth fits here, let's work upwards and see if we can find evidence for sea level fall. We're still hummocky here but when we get to this position we see an abrupt juxtaposition of finer growing heterolithic sediments onto our lower shoreface sandstone. Now initially we might interpret this as a flooding surface, evidence of sea level rise. However when we look in detail at these facies we see no bioturbation and no evidence for them being marine; we therefore interpret them as marginal marine, maybe estuarine, so that's suggesting the fact that this surface represents a sea level fall, and therefore a sequence boundary.

The next stage is to trace this sequence boundary laterally, see what happens to it, so I'm going to walk this way tracing the sequence boundary which is a juxtaposition of the hummocky lower shoreface with the heteroliths. Now when we get to this position we see a high angle erosion surface as cutting down. Now that's a younger surface than those heteroliths, it's cutting steeply down, truncating both the heteroliths and successively that shoreface sandstone. And we can follow this erosion surface all the way down to ground level here. What's above the erosion surface? Well this is actually the surface we saw from the other side of the valley, and this is that major lenticular sandstone body. Let's have a look at the internal details of it. First of all it's slightly coarser-grained than the shoreface deposits underneath. Secondly we see current ripples, we see a lot of low angle laminations, and importantly those laminations are draped by pterigenous coaly material. We also see on the under surfaces fossilised tree trunks, some of which are bored by the marine bi-valve pteridemites; that's significant because tree trunks were floating in saline water so the saline water, the mud drapes, all of these characteristics are consistent with this being a tidally influence channel. So putting the evidence together here, our interpretation is that of a sequence boundary and incise valley fill. The key observations are that lower shoreface strata are truncated by a surface with relief on it, and above that surface we have tidal channel deposits in some places, tidal flats in other places. The key point is that these are shallower water rocks and that must represent a falling sea level. To clinch that interpretation, however, we need to map that surface regionally.