Line 442-3 “ophiolite obduction reconstructed by rapid, stepwise sedimentation.

The ophiolite started off as oceanic crust with a monotonically increasing temperature gradient with depth from 4 deg C at the sea bottom to say 1300 deg C in the asthenosphere. During the obduction process heat would have been lost both from the top by and from the base to the cooler autochthon (perhaps initiailly 25deg) below. The resulting transient temperature gradient within the ophiolite would have developed to a curve with maximum somewhere near the middle of the nappe and then developed back towards a monotonically increasing temperature with depth to the base, a substantially lower overall temperature towards a steady state gradient governed eventually by the conductivity of the ophiolite. So, over some time period, during the obduction process, the thermal anomaly of the oceanic crust would have dissipated towards a slab with a liner temperature gradient that was reached by progressive cooling. In the subjacent autochthon temperatures would have progressively increased during this whole process at a rate governed by basal heat flow, the heat anomaly of the slab, its thickness, and its conductivity I would expect there to be an additional complication, due to the lateral motion of the slab over the cold autochthon, of a lateral temperature gradient within the slab as the rearward portion of the ophiolite would be obducted over autochthon that was pre-warmed by the leading edge. This is indeed alluded to by the authors observationally on page 21

As far as I can understand in the model used in this work, the ophioilite is either modelled as an advancing sediment wedge, like an extremely rapidly-deposited delta, or essentially instantaneous deposition of sediment over the whole model at one time like a “pelagic rain”. In either model the ophiolite is initially deposited cold (as sediment grains) and so fast that the initial state is close to instantaneous loading ie there is virtually no temperature gradient from surface to base ophiolite. The transient temperature gradient in the ophiolite is then simply one of warming due to the basal heat flow and the thermal blanketing effect of ophiolite conductivity and thickness. The ophiolite is thus simply a sink for heat energy and not a source as in the previous described case. In the autochthon, as in the model described above, temperatures steadily increase at a rate governed by the overlying ophiolite conductivity and thickness and basal heat flow and underlying conductivity model. There is also a lateral temperature gradient in the “ophiolite delta” case as the transient has had more time to develop in the rear of the advancing slab, but there is not in the pelagic rain approach.

I notice that in Figs 7 d and e the ophiolite a temperature structure is left white. Why? But I can see the temperature structure in the ophiolite in Fig 8 where it is indeed a transient warming from an initial uniformly cold state which looks to be about 30 deg C. I conclude that the ophiolite is modeled purely as a heat sink. I find it geologically difficult to understand how the entire slab can have got this cold in the actual obduction process

The sensitivity analyses presented and the back-up data in supplementary information are all variations of the sedimentation modeling approach. For me they don’t help address the actual sensitivities unless and until there is some justification for the sedimentation approximation being a good one.

The model output is tuned to an accepted, reasonable, simulation because it matches observed temperatures and pressures.

I would like to see some justification for why the cold “sedimentation” approach, with a completely different set of transients, should be expected to give meaningful results for an initially hot (even if by the time of interest strongly-cooled and cooling )thrust slab.

I would also like to understand why, even if the temperature history is matched ,the modelled thickness that goes with those temperatures and hence the pressures, be a good match to reality.

I apologise if I’ve completely misunderstood or otherwise missed the point here, but at the least, I find the current text and explanation to be an inadequate description of the modelling method and assumptions.