Stick 25.3 to 25.95 m

General

* Pale grey, medium to coarse grained arenite – coarseness of stick changes you move into the zone of deformation, grain size seems to be enlarged within the brecciated zone
  + Is this due to a fault zone process? Heat and pressure affecting porosity and outside casing has weathered away/alternatively cement of sandstone has eroded/transformed?
  + Coarsest in the crushed area/shear zone
* Thinly laminated to laminated bedding? Not strongly bedded but it is faintly present
* Bedding clearly defined through slight change in composition, as well as small lenses (?) of material (possibly carbonaceous) more apparent between 25.75 to 25.95 m
  + Appears to have different bedding directions at top (~25.3m) and the bottom (~25.84m)
  + Helps define bedding plane
* Minimal black components in bedding at top of stick above brecciated zone – not uniform throughout the whole layer, likely carbonaceous material – as well as below the brecciated zone, some thicker sections of layers at the base
  + Weak, scratches away with nail and leaves black powder
  + Finer grained, grain size not distinguishable with the hand lens
* Top 1 to 3 cm of core (25.3 to 25.33 m)
  + Change in composition at the top of the stick, slightly different mineralogy, marginally darker in colour, helps define bedding plane in this section of the core
  + Bedding dipping towards the east, well defined due to colouring and possibly slighter smaller grain sizes
* Brecciated zone/sheared zone takes up large majority of the stick (25.35 to 25.75 m)
  + Near planar to undulated boundaries cut by joints, potentially a sheared surface, will be able to tell with further analytical work
  + Predominantly lenticular to wedge shaped blocks
    - Range from 5mm to 100 mm to 200 mm (blockier)
    - Thicker, less fractured sections in the brecciated zones
  + Blocks of sandstone around the more cement-rich section of the core finer than areas less dominated by cement (more space for clay to take up
  + Clay? Or carbonaceous material cement? Graphite? Infilled in sheared zone – is this a product of fluid moving through the porous sandstone? Not only is there this dark clay cement but there is also vertical fluid lines in the X portion of the sheared zone
  + Fractured at base of zone at 25.75 m (?) but it is slightly above the actual fault plane – weaker plane?? Why may this have happened?
  + Plane of weakness with stress applied through drilling?
* Apparently faintly cross-bedded based on the core log produced at initial logging after coring in 2016 – no resin, this may be obscuring
  + All this would contribute to is the depositional environment which we are already aware as being marine
* Biggest question: **what is happening with the orientation of the bedding down the length of the core??**
* Fault appears to be striking north-north-west, dip slip movement?
* Brecciated zone not fine grained, still blockier segments (resistant mineralogy)

Stick 40.16 to 40.43 m

General

* Reddish yellow arenite – can see lesser weathered material through base (~40.42 m) of the core, pale white/grey sandstone, backed up by initial photos of the core log taken at time of retrieval (2016)
  + Oxidation occurred on the surface layers – can explore this when the core is cut in half, most likely weathering that occurred as the cores sat in the tray storage
* Medium to coarse grained sandstone, thinly laminated to laminated bedding
* Dark banding consistent with bedding plane – carbonaceous material again? Layering much more strongly defined, black material consistent across bedding plane (mostly consistent in thickness of the layer and uniform)
* Parting occurs along the bedding plane, suggests that these layers are mechanically weak
* Some sections feel soft/friable on the outside/base of core – likely that this is due to the weathering that occur in the tray post collection
* Parts of the core are more weathered which defines the bedding plane more – compositional difference of the layers, layers that weather more have more minerals that oxidise within them?
  + Darker red/brown sandstones (from weathering) 1-3 mm thick bedding
  + Intermittent with black bands < 1 mm to 2 mm thick, in between yellowed sandstone
* Is the top of the stick (40.27 – 40.43 m) a separate fault zone - appears as if orientation is opposite direction (fault plane at 40.22 m = 350° / 50°  / W) to the fault zone at the base
* Top of core appears to show potential displacement from top fault system, a displacement of only 1mm or so, through
* Base of core you can see faulting from second faulting system has resulted
* There is parting that occurs along the bedding plane – mechanically weak plane?
* Top fault zone striking north-north east, dipping in a north-westerly-westerly direction quite steeply (nearly vertical in dip)
* Bottom fault zone striking north-north west dipping in a north-easterly direction less steeply

Stick 40.72 – 40.82 m

General

* Two planes with different slip events/directions at different times? Slickenlines
  + Top slicken lines are the same faulting event as displacement (deformation bands) observable
* Parting occurs along bedding plane
* Deformation bands, one main fault through this section of the stick, appears to match orientation of the base of the 40.16 – 40.43 m section
  + 7mm to 9mm, smaller 5 mm to 6 mm
  + Tabular deformation zone
  + Cluster zone, main deformation as a result of fault damage zones
* Displacement traced through some of the deformation bands – 3 mm
* Shear across bedding plane
  + Want this as a thin section – what do slickenlines look like under a microscope
  + Minimal parting along bedding plane but still present after faulting – mechanically weak
* Black bands 1 mm to 4 mm, largest compositional gap is 22 m when denser only 1 mm to 2 mm, densest at 40.74 to 40.78 m
* Bedding plane exposed at base of 40.82 m
  + Grey, metallic, shiny, smooth, lose material created when scratch with nail – fine grained/weak?
  + Platy with hand lends
  + Graphite?

Based on the 40.72 to 40.82 stick, it appears there’s two planes showing two directions of movement. The bedding plane (showing black, shiny material) exposed at the bottom (40.82 m) has slickenlines that show lateral movement – strike-slip movement. The plane exposed at the top (40.72 m) is the same angle as the fault plane and has slickenlines on it that are vertical – the movement that occurred on this plane would have been dip slip movement as the deformation bands demonstrate the right hand side of the lefthand picture of the core has maintained position (or moved up slightly) and the right hand side with deformation bands has moved downwards – normal movement.

A close-up of a chain

Description automatically generated with low confidenceStick 25.3 to 25.95 m

Fault at 25.64 to 25.81 m

* A = 291° / 50° / SSE
  + Secondary measurement 293° / 49° / SSW
* B = 231° / 39° / SE
  + Secondary measurement 256° / 47° / SE
* C = 234° / 48° / SE
  + Secondary measurement 248° / 50° / SE
* D = 250° / 58° / SE
  + Secondary measurement 247° / 50° / SE
* N = 256° / 48° / SE
  + Secondary measurement 267° / 41° / S
* In between N and A = 276° / 42° / S

Bedding

* At  25.33 m = 260° / 30° / SE
* At 25.34 m = E = 281° / 30° / SE
* At 25.48 m (PT in SZ) = F = 259° / 53° / NNW
* At 25.54 m (PT in SZ) = G = 224° / 50° / NNW
* At 25.63 m (PT in SZ) = L = 235° / 39° / NNW
* At 25.82 m = 284° / 59° / N
* At 25.84 m = H = 270° / 50° / NW
* At 25.82 = P = 284 / 59 / N

Fracture at 25.58 m

I = 345° / 68° / SW

Fracture at 25.47 m

J = 331° / 72° / NE

Fluid Lines at 25.5 m

K = 63° / 156°

Fracture at 25.49 m

M = 242° / 59° / NNW

Fracture 25.64 m (through bedding, not parallel)

O = 002° / 22° / E

Stick 40.16 to 40.43 m

A picture containing lawn mower, linedrawing

Description automatically generatedA picture containing sky, linedrawing

Description automatically generated

A – fault plane at 40.22 m = 350° / 50°  / W

B – parting on bedding plane at 40.30 m = 272° / 72° / NNE

C – parting on bedding plane at 40.24 m = 270° / 73° / N

D – bedding at 40.3 m = 294° / 70° / NNE

E – parting/join at 40.19 m = 246° / 37° / NNE

F – Bedding at 40.24 m = 316° / 65° / NNE

G – fracture from fault zone at 40.27 m = 200° / 84° / NW?)

H – parting at 40.34 m = 241° / 59° / NNW

I – fault plane at 40.41 m = 355° / 72° / NE

J – fracture at 40.2 m = 216° / 77° / NW

K – plane in fault zone at 40.40 m = 351° / 62° / NE

L – black bedding band at 4.38 m = 284° / 78° / N

M – bedding = 291° / 62°/ NNE

N – black bedding band = 220° / 70° / NW

O – further down plane of black bedding at 40.37 m = 214° /60° / NW

P – fracture at 40.26 m = 342° / 78° / NE

Q – bedding at 40.41 m = 220° / 65° / NW

R – bedding at 40.20 m = 255° / 61° / NW

S – parting at bedding at 40.27 m = 251° / 69° / NW

T – parting at bedding plane at 40.22 m = 208° / 48° / W

A picture containing linedrawing, insect

Description automatically generatedStick 40.72 to 40.82 m

A – first fault plane of deformation bands at 40.79 m = 333° 72° / NE

B – bedding plane at 40.82 m = 254° / 71° / NNW

C – fracture at 40.79 m = 200° / 79° / W

D – other deformation band plane at 40.78 m = 327° / 68° / NE

E – top exposed surface (fault plane) at 40.72 m = 328° / 70° / NE

F – bedding plane at 40.74 m = 249° / 76° / NW

G – slicklenlines on the top (plane at 40.72 m) = 36° / 146°

H – slickenlines on the bottom = 10° / 84°

I – bedding plane at 40.80 m = 223° / 57° / NW

Meeting

* + - Call David to see how to progress in terms of the orientation of the core
    - Attach photos to questions so that they’re associated to a visual guide
    - Maybe scanning will give more clarity to the images
    - Add disaplcement measurement for the base of the 40.16 to 40.42 m
      * May see specific minerals associated with different degrees of displacement
    - Density of the fractures in the core
    - Haakon fossen papers structural geologist sandstone Norway
  + Email guy – timeline, rock splitting
  + W50