**Oman Drilling Project – BT1 – Lead Scientist On-Site Log (LSOS).**

**March 6th 2017 to March 22nd 2017**

This is an electronic version of the blue on-site logbook.

**BT1 23.36434N, 58.18262E, Altitude 292 m (±8 m).**

Hole BT1A drilled to 1.9 m then decision made to re-site, 4m closer to outcrop.

Hole BT1B. Inclined at 75 deg., trend: 030 deg.

***Overview***

**DAILY UPDATES**

**4th March, Saturday**

PK and NB to BA2

JC, RL, DN, EP, DZ, NW to GT3.

Packed up scanner, took down tent and tarp.

Moved to BT1. Sultan dropped off scanner (using his pick-up truck) and Gopi delivered tent poles and boards for scanner to sit on (and spare matresses for packing boxes) using his pick-up truck. Lalbuksh truck delivered water container, saw, toilet. Pitched tent and tarp. Late lunch delivered by Sultan. Rig arrived at site. Wali having trouble getting the truck with the rest of his gear across the wadi as the track is so windy and sandy. Trying to make a straighter route, w/digger.

JC and DN went to GT3 to supervise loading of core boxes. All back to base.

**5th March, Sunday**

Moving from Ibra to Lizugh. Packed up our apartments, leaving a few things for Nico in apartment 10, upstairs. We will take router, Nico will use his Omani SIM to create a hotspot for running the cuttings DIS backup.

Gopi and truck will arrive ~11am. Nehal expects we will load, then move to Lizugh after lunch.

Wali and team moved to Muscat last night at midnight. Road to site is now okay, but still need to set up, so probably no drilling today 🡪 RL, EP, DN, DZ will go on a trip to BA2 and then Falej village. PK and JC waiting at apartment for truck to come and load furniture. Working while waiting.

Truck took furniture. 4pm, JC to Lizugh to meet Gopi and Nehal to check apartments before furniture unloaded into all. PK collected Craig Manning from MCT in evening.

**6th March 2017, Monday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW**

Started drilling Hole BT1A

Arrived on site: 07:05

Rig started: 09:48

Rotation started: 11:16

07:05 Drillers not here yet. No water in their pits/tanks. No water in our tank!

Sam McNeill on site filming again – stayed to see start of drilling, then left.

Finished setting up tent – cables + extension leads, added extra tarp.

Still waiting. JC showed RL how to use core scanner. PK took others on a trip up the wadi to show section we aim to drill, while JC and NW stayed to wait for water and progress…

DZ and DN went back to base to collect forgotten lunch.

10:25 water truck arrived and boys returned with lunchbox.

Only Wali, Jameel and Khaliq on site today, no fourth driller. Clearly slowing things down…

Drilled 1.90 m (BT1A-1Z)

~12:50 PK decided to move the rig closer to the outcrop to reduce distance to be drilled through alluvium from estimated 22 m to estimated 14 m, as keep getting stuck. Limiting factor is length of rod slide.

Water truck is stuck at entrance to site so PK and CM helping to dig it out while Wali + Khaliq and Jameel move rig etc. Truck freed using palm debris from the wadi! Moved rig. Spent a couple of hours hacking at the base of the outcrop in order to make enough space for the rod slide ramp.

16:40 – done.

**7th March 2017, Tuesday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW**

Started drilling Hole BT1B

Arrived on site: 06:55 Drillers arrived 07:05

Rig started: 07:15

Rotation started: 07.30 – spud in for BT1B

PK made the decision to discard the rubble (alluvium) drilled from BT1A.

Decided to switch from red to blue for marking base of cores as shows up better on listvenite. May need to return to red for other rock types in this hole.

After core 2Z POOH, Reaming/RIH with casing (HW) w/shoe bit.

Sequence goes:

Drill HQ 🡪 POOH HQ 🡪 Ream HW 🡪 Drill HQ 🡪 POOH HQ 🡪 Ream HW etc.

So, effectively incremental casing, using casing shoe to ream.

~14:00 Drillers waiting for water.

~14:30 Water truck arrived

Ghost material from 7Z (run 2) was not kept as rest of core is continuous.

16:20 – tried to cut core 7Z (in order to fit in box) – saw broke – Dave Z saw it fall of the truck when delivered to site 🡪 told JC (Saturday), who asked Gopi (Gopi denied that this happened) 🡪 NW, JC and Gopi checked the saw (also Saturday) – was slow to start but worked. Now, when switched on today the wires melted and smoke came out of the control box. Saw stopped. Gopi on his way to site to deal with this.

Gopi arrived – he will take the saw to Muscat to be fixed tonight. Should return with it at 7 am tomorrow. Casing now set to 6 m (into bedrock). No water loss. Rocks very slow to drill w/ shoe bit, so plan to continue drilling HQ now, no further advance of casing at this time.

**8th March 2017, Wednesday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW**

Arrived on site: 07:10 Drillers had just arrived, overtook water truck crossing wadi

Rig started: 07:12

Rotation started: 07.44

First operation by drillers = bit change (HQ) – new.

07:25 Spoke to Gopi on the phone – he is in workshop with saw and will update us in 30 mins.

08:45 Still no news from Gopi. Another core will be on the deck soon, and now have another very long piece that needs cutting to fit in box, so decided to break long sections with hammer. Tried hammer – hitting them against base of outcrop works better.

🡪 8Z has 5 sections now, instead of 4.

Lunchtime – Gopi delivered saw. New switch box. Water and saw on separate switches again – Much better.

17:45 Rig System Pressure (kgcm-2): ~100-150 Pull Down (kgcm-2): 50, steady

 Bouncing back and forth every <1sec

Geology:

Slow and steady, 18 m of veined listvenite with core-scale variability. Nice to be going smoothly after a long start up period. Deferred setting more casing until tomorrow sometime.

**9th March 2017, Thursday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW**

Arrived on site: 07:05

Rig started: 07:10

Rotation started: 07.15

07:30 Rig System Pressure (kgcm-2): 100, steady Pull Down (kgcm-2): 40, steady

09:15 Group of 20 students from SQU visited site. PK took tour up wadi to show outcrops. Showed maps & diagrams, then core flow. Students ate “breakfast” provided by SQU. Visited for ~ 2 hours.

100% loss of drilling fluid circulation today. Two water trucks making deliveries but result = cuttings = difficult to clear.

21Z Low recovery due to highly altered, fractured, fragmented material.

14:35 Rig System Pressure (kgcm-2): 100, steady Pull Down (kgcm-2): 40, steady

Pipe looks like it is wobbling quite a bit – because no drilling fluid return?

15:15 Bit is not working okay, needs check-up. POOH. Bit has become smoothened by formation. Drillers exposed the second layer with chisel and hammer to sharpen the bit. RIH.

16:00 Drilling restarted.

Geology:

All listvenite, but strongly heterogeneous textures: weathered massive list, some prominent gneissic fabric in long intervals, fuchsite in numerous sections.

**10th March 2017, Friday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW**

Arrived on site: 07:15

Rig started: Already started

Rotation started: Already started

08:45 PK and JC left to scout site for MD1

12:00 Rig off.

Geology:

Gneissic to mylonitic listvenite early, then started recovering serpentinite. Possible dolomitic zones near transition. All cores record strong deformation, weak to intensive banding.

**11th March 2017, Saturday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW**

Arrived on site: 07:10

Rig started: 07:12

Rotation started:

First operation: POOH, change bit. Finished ~07:55

~09:00 – 11:40 Group from Japanese Universities visited. PK took tour up wadi, showed core recovery + flow. Now PK taking them to see BA2 site.

~11:00 Green water truck = broken down. Gopi says he will bring a mechanic to fix it.

12:30 Brought bit up again (after 3.05 m advance) to sharpen “teeth”. Bit is getting polished by hard, quartz-rich rocks. Wali explained that at previous sites he used a no. 7 bit (for altered gabbros and diorites). Now he is using a no. 10 bit (hardest in scale) for quartzite and similar.

14:30 Blue water truck arrived to fill drillers tanks. Still no sign of mechanic. Still losing 100% circulation.

15:35 Mr Prabhakar visited site.

15:40 Rig System Pressure (kgcm-2): 110-120 Pull Down (kgcm-2): ~40, steady

16:10 Green truck apparently needs fuel filter replaced. New part to be fitted tomorrow morning. Will continue with blue truck in the meantime.

**12th March 2017, Sunday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW, JdO (+ Hamood S & Shihab B, MRMWR)**

Arrived on site: 07:15

Rig started: 07:15

Rotation started: 07:45

RIH after another inspection and sharpening of the bit again last night.

Green water truck fixed in am.

14:10 Rig System Pressure (kgcm-2): 160-180 Pull Down (kgcm-2): 80, steady

Grinding noise from pipe – Nehal and Wali explained that this is due to vibration of drill string within casing – goes away when rotation speed is increased.

Geology:

Intersected contact between listvenite and serpentinite at ~80 m, listvenite above continued to show mylonitic and cataclastic fabrics suggesting strong deformation associated with contact. Serpentinite below locally strongly sheared, but contains patches of mesh texture that is relatively undeformed. It looks like the serp-list zones at base of ophiolite could be strongly tectonized in distributed shear bands. Will be interesting to see what controls CO2 metasomatism in this context.

**13th March 2017, Monday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW, JdO, NB (+ HS, SB, MRMWR)**

Arrived on site: 07:05

Rig started: 07:05

Rotation started: 07:15

~08:15 JC and DN to Muscat to work on shipping issues

10:40 44Z, spectacular transition serp 🡪 list

15:45 Tripping pipe to look at bit due to slow advance

16:52 Drilling (to advance) re-started

**14th March 2017, Tuesday**

**On-site: PK, CM, JC, RL, DN, EP, DZ, NW, JdO, (+ HS, SB, MRMWR)**

Arrived on site: 07:05

Rig started: 07:05

Rotation started: 07:15

13:00 Core barrel problem – lock at top of core barrel failing to engage – need to trip pipe to retrieve.

13:34 On deck.

14:10 Bit has been sharpened, started RIH

17:10 Stopped drilling for day.

**15th March 2017, Wednesday**

**On-site: PK, CM, JC, RL, EP, DZ, NW, JdO, (+ HS, SB, MRMWR)**

Arrived on site: 07:10

Rig started: 07:10

Rotation started: 07:15

~09:30 Visit from four members of staff from the MRMWR geophysics team.

~10:45 PK and DZ to SQU – PK giving seminar.

14:45 Wali is annoyed that there is no water tanker right now, we are losing 100% circulation. Blue truck driver (who has been substitute for broken green truck (fix didn’t work)) cannot come now as he had to go to Rusayl (only just called wali to say). Nehal, Wali and JC told Gopi to arrange another tanker immediately, Water in tanks can keep drilling going for now but then will need another water delivery. Wali told JC he can keep drilling for maybe an hour with the water that he has. Gopi driving to Lizugh water station to arrange another tanker now. Hamood is going with Gopi to help talk to the drivers. Wali told Nehal that he can only drill another 30-40 cm before he will need more water. No drilling for now… (since 63Z).

15:55 Gopi and Hamood return. Blue truck on its way. Drilling restarted.

Rig has been getting very hot over last few days – Wali’s team intermittently throw water onto the engine using a bowl…

Geology:

Listvenite all day, in its many-splendored varieties!

**16th March 2017, Thursday**

**On-site: PK, CM, JC, RL, EP, DZ, NW, JdO, (+ HS, SB, MRMWR)**

Arrived on site: 07:10

Drillers arrived right behind us. Sultan also here. Blue truck driver here when we arrived, filling green truck from blue truck.

Rig started: 07:15

Rotation started: 07:20

Changed to 3.00 m HQ pipes today.

13:03 Green water truck is moving after 5 days sitting inactive!

13:45 Wali will POOH to check bit – pressure is increasing, so if bit is worn down will change to a new bit. If bit is fine, will change down to NQ (stopped for lunch before POOHing).

PK went to get cold drinks for drillers and science team

14:45 Bit is in quite good condition. Wali recommends changing down to NQ as high torque is not due to bit being in poor condition. CM and JC agree (PK does too, said so before leaving).

15:50 Stopping. 132 m of NW casing installed so far. More tomorrow. Tables clear.

**17th March 2017, Friday**

**On-site: JC, NW**

Arrived on site: 09:55

Rig started:

Rotation started: 10:00

10:00 Preparing to start drilling after NW casing installed to 167.10 m

10:03 Started drilling (NQ)

Lots of tan coloured mud coming up now that circulation is restored!

One core drilled today. PK and CM arrived (from visiting potential MD1 site) as core was being received at core deck by JC and NW.

**18th March 2017, Saturday**

**On-site: PK, CM, JC, RL, EP, DZ, NW, JdO**

Arrived on site: 07:05

Rig started: Already started

Rotation started: 07:10

Return circulation (80%) is much clearer than yesterday. Not red… milky

08:00 Rig System Pressure (kgcm-2): 200, extremely steady

Pull Down (kgcm-2): 80, steady

~09:20 after 71Z, switching rod guide to NQ from HQ (needed to loosen it by drilling with NQ first before it could be removed)

~09:50 Drilling restarted

~10:00 Group of 20 students from GUTech, led by Ana J and Wilfried, arrived. PK took tour up wadi and then showed maps, sections, graphs and core flow.

12:05 73Z has list-serp contact. Yay!

Switched to marking bottoms of pieces with red again as blue is difficult to see on serpentinite – switched back to blue again when returned to listvenite.

75Z More listvenite

Bottom of 78Z, 70 cm of ?smectite-rich zone, possible/probable fault gouge

79Z strongly fragmented chl- and epidote-bearing, fine grained rocks. Suspect we have intersected basal thrust or at least a splay.

**19th March 2017, Sunday**

**On-site: PK, CM, JC, RL, EP, DZ, NW, JdO (+ AA and MA, SQU)**

Arrived on site: 07:12

Rig started: Already started, Wali and crew cleaning out mud channels

Rotation started: ~07:25

07:35 Rig System Pressure (kgcm-2): 200, steady Pull Down (kgcm-2): 40, steady

~10:00 Al-Moatasem and Monther (SQU graduates in geology) arrived at site – this weeks trainees.

Geology:

Greenschist grade metasediments and metabasalts. Pleasures of ptygmatic and sheath folds, joys in occasional graphite, hematite, calcite. But hard to believe this offsets the pain of curating intricately fractured core pieces in > 40**°**C heat.

**20th March 2017, Monday**

**On-site: PK, CM, JC, RL, EP, DZ, NW, JdO (+ AA and MA, SQU)**

Arrived on site: 07:15

Rig started: 08:00

Rotation started: 08:10

Engine maintenance was underway when we arrived on site.

07:40 PK and JC assessing options for removal of core boxes and scanner from site in case of heavy rain (forecast starting tomorrow, for whole country, difficult to get more localized forecast).

~08:30 Asked Gopi if possible for Lalbuksh truck to come today to take away the core boxes? Gopi will get back to us when he has spoken to Prabhakar.

08:35 Rig System Pressure (kgcm-2): 200, steady Pull Down (kgcm-2): ~50, steady

~11:50 Truck arrived. Not enough belts (ratchet straps) – only able to pack/load two pallets. Waiting for Gopi – will bring more.

~13:00 Gopi arrived. Men will go for lunch and bring more belts when they return.

14:30 Truck team returned, refreshed and with straps for boxes. JC and Gopi supervised loading of truck. Will go to Lalbuksh camp now and driver will deliver to MRMWR storage area at Mubailla at ~6.30 am tomorrow. JC called Ali Al Shukaly – he is happy + PK will go to see him (and storage room) tomorrow too.

~16.30 Andreas (SQU) and Kathi (GUTech) visited site. PK gave tour.

Last Geological Summary from Craig:

More intimately folded and foliated greenschist facies metasediments, w/ a few volcanic-looking intervals and, at the end of the day, spectacular breccia rocks in cores 100Z and 101Z onward!

**21st March 2017, Tuesday**

**On-site: PK, JC, RL, EP, DZ, NW, JdO (+ AA and MA, SQU)**

Arrived on site: 07:10

Rig started: 08:10

Rotation started: 08:20

07:10 Wali and crew fixing a hydraulic leak that apparently started last night during the final run.

14:30 PDO visitors (3 people) arrived. JC showed coreflow, the PK & JdO took them up the wadi.

17:00 Rig System Pressure (kgcm-2): 200, steady Pull Down (kgcm-2): 20, steady

Heavy rain forecast. Sultan and his brothers contemplating moving the rig up onto the wadi terrace. Decided not to. We moved the 10 core boxes stacked behind the tent to PK’s landcruiser. Box (lid) on scanner. Anything that could blow away 🡪 stored in office overnight.

Geology:

Light and dark green, foliated metaseds and metabasalts. Highly fractured.

**22nd March 2017, Wednesday**

**On-site: PK, JC, RL, EP, DZ, NW, JdO (+ AA and MA, SQU)**

Arrived on site: 07:20

Rig started: Already started

Rotation started: Already started

No issues apparent, despite heavy rain last night.

~10:00 Group from College of Higher Technology visit – JC showed core flow, JdO (& RL) took tour up wadi. Two French Mattieus joined them for wadi walk.

10:30 Cleaning hole so delay before retrieving final core.

10:56 LAST CORE OF PHASE 1!

11:10 POOHing

~ 12:00 Visit from Journalist from Oman Observer – Interviewed PK.

Geology:

Highly fractured metasediments and metabasalts. Some cores exhibit highly sheared \_\_\_ with qtz calcite veins. Pyrite crystals visible in some cores.

PK:

Evening – waiting for expected visit from SQU Vice Chancellor Ali Al Bemani plus Dr Rahma and Prof Sobhi Nasser, hoping the drill will still be in place when they arrive. (Was, showed some core and the drill).

Looking back through this book, feeling very grateful to all the people who gave their time to make this Phase I of OmDP a complete success.

JC, JdO, NW, RL, EP, DZ, AA and MA (SQU), CM, HS, SB, EB, LF, MB, TM, CMacL, JL, JM, SA & SA (PAM), Wali, Gopi, LK, DT, NB, BI, JK, GFG, JN, MH, DM… THANK YOU ALL!