Bats below the Lake Bed:
Layla Lakes and their Wonders Revisited.

Day 2: 29th of January, 2011, Layla Lakes

On the next day, after having a frugal breakfast with some coffee and cookies, we pack up. The weather is cool, overcast and there is moisture in the air. Some dew has fallen. For today we plan to show Niklas and Tobias some of the nicest tufa forms, to check out one more dark overhang in the large sinkhole and to take more pictures of the qanats for a planned calendar on water and desert.

Thus we drive around the western side of the large sinkhole and park at the former beach-access area, marked by a row of black and yellow steel posts. From here we first walk down to see pit 4a (Figs. 25, 26) and the large tufa bodies along the walls of the large sinkhole (Fig. 27). It is a small sinkhole set into the slope of the large structure but its northern wall has the most regular gour-like tufa. Heiko has put his red helmet on to provide a contrast to the brown and tan colors.

Fig. 25: Heiko Dirks in Pit 4a.

Fig. 26: Pit 4a with gour-like back wall, now already partly filled with drifting sand.

Fig. 27: View west from pit 4a.

People have different talents: Tobias for example is a serious fisherman, member of a German fishing association. What does a fisherman look for? Fishing hooks, obviously. And what does he find in the drifting sand on the bottom of a former lake? Fishing hooks, obviously! (Figs. 28, 29). And what does that tell us? Formerly there must have been fish in the lake! Heiko and I had suspected that already in 2008 because we found round depressions in the mud, such as would be made by fish to hatch their eggs, but that was not really firm evidence. A fish hook, however, is proof! Even more: Tobias later stumbles across a makeshift wire-frame and immediately identifies it as a fish trap (Fig. 30). It take the eye of the expert to see that. We would just have passed by, noticing only another piece of garbage. The next question to solve is: was that an introduced species or an endemic fish, adapted to this isolated habitat. In our work on alkaline Lake Van in Turkey, we also investigated the famous *Chalcalburnus tarichi*, one of the few fish species adapted to highly alkaline conditions (Danulat & Kempe, 1992).

Figs. 28 and 29. Tobias Fuest finds a fish hook, proving that the lake must have had a stock of fish.

Then we move to the north to check out the last large and looming opening, just to find out it is one more of the overhanging niches (Fig. 31). To the left the tufa has collapsed already, threatening a section further south as well (Fig. 32). This is most probably the ultimate fate of the gypsum tufa forms: as the sediment behind shrinks due to evaporation, the solid, macro-crystalline rock lining detaches from the wall and collapses under its own weight. The northeastern side of the sinkhole has already collapsed along a stretch of at least 100 m. It would be very interesting to follow this disintegration and we plan to bring a 3D Laser Scanner (for which I have applied already) and document the current state of the gypsum.

Fig. 30: A home-made fish trap rests on the bottom of the former lake.

At the floor of the sinkhole many black, long-legged beetles roam. They stand with their back raised to the wet wind, trying to catch some of the moisture (Fig. 33).

Fig. 31: Niklas in a large niche in the NW wall of the large sinkhole.

Fig. 32: The niche is in front of Heiko. Above him a large section of the tufa wall has already collapsed (he is standing on the tumbled masses) and the section in the background shows large fractures.

Fig. 33: Long-legged beetle that roams the sand at the bottom of the lake.

Still hoping to find a genuine cave, Heiko, Niklas and Tobis stumble across (not into) a 2x1 m large opening below the side of a low mound (Fig. 34). As we peer down into the darkness below we notice that the pit is overhanging an all sides. Lowering the tape, the depth is 9.2 m. We decide to get rope, ladder and equipment from the cars. By 2 PM the pit is rigged and Niklas is the first down the ladder on belay (Fig. 35). He shouts back that there is a passage down there! In addition there is an old oil drum (people like to throw things down into

pits…) and a 4 m high tree trunk.

Fig. 34: Heiko peering into the newly discovered Pit 4d at the lake floor.

Fig. 35: Niklas before climbing down the 9 m deep pit.

Fig. 36: Heiko on the ladder going down the pit between walls of gypsum.

Heiko follows with the survey gear. (Fig. 36). After some time, they reappear and we lower the ladder to them for a second pit inside. Tobias and I are destined to wait. Finally the sun gets through and it becomes warmer. Tobias has a blue Tuareg scarf and sits like a true Bedouin on top of the mound above the pit, while I retire to the shadow of one of the gypsum reefs, trying to sleep a little. As the earth turns around, the northern end of the sinkhole gets the warm evening sun, bringing out the colors of the tufa more vividly (Fig. 37; 38, 39). Meanwhile, we wait, taking pictures, for example of the old pumping platform, seen from below (Fig. 40). From his vantage point Tobias observes a fox roaming about that later is seen at the rim of the sinkhole, outlined against the sky. An owl hoots from above and as night approaches is seen to perch on a rock atop the eastern wall.

Fig. 37: The setting sun paints the northern end of the big sinkhole in warm colors.

Fig. 38: Tufa gours and sand on the NW side of the large sinkhole.

:

Fig. 39: Gastropod shells immured in gypsum.

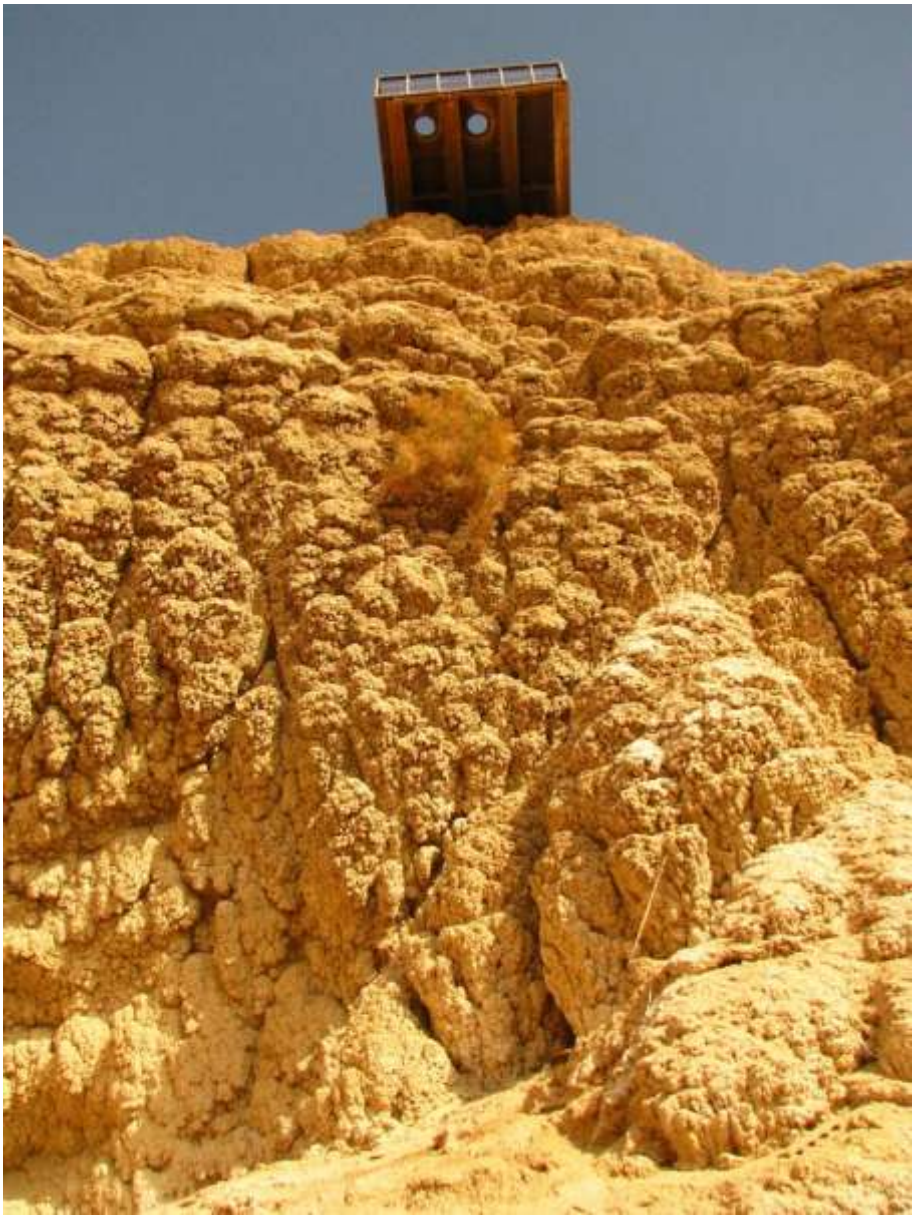

Fig. 40: The pumping platform from below.

From time to time we peer into the pit and listen (Fig. 41), but Niklas and Heiko are gone. Later we find out that they did not have a watch with them and did not feel that they were gone for four hours. Shortly before 6 PM, Tobias finally hears faint noises, just in time for him to walk to the cars to make the safety call to the GIZ, telling Andreas Deckelmann on duty, that we are alright. It gets dark quickly and before the two finally reappear and work their way up the ladder it is 7 PM. Their notes show that the bottom of the pit is quite wide, filled with lake chalk (Fig. 42). Roof and walls as composed of bulbous gypsum tufa. A passage goes off to the north leading downward and making a turn back to the pit. Here the two encounter another pit. With the help of the ladder, they climb down to a substantial chamber, 20 m below the entrance (Figs. 43, 44, 45). A continuation leads upward, back below the entrance pit (Fig. 46). All in all, the cave is about 50 m long and the first of its kind world-wide: a primary cave in lacustrine gypsum tufa. Possibly it served as an ascending pipe for the ground-water welling up from below.

Fig. 41: View up the pit with Heiko, Tobias and Stephan peering down (Photo N. Gassen).

Fig. 42: The bottom of the pit is filled with a cone of lake chalk (Photo N. Gassen).

Fig. 43: The pit, leading down over a bench of gypsum tufa (Photo N. Gassen).

Fig. 44: Niklas at the bottom of the pit in the lower chamber (Photo H. Dirks).

Fig 45: Niklas negotiating his way down the pit inside the pit (Photo H. Dirks).

Fig. 46: Niklas at the end of the lower chamber looking at the sediment cone, coming down from the entrance pit. Note solid gypsum tufa on ceiling (Photo H. Dirks).

Fig. 47: Head of a half-mumified fox at the bottom of the pit (Photo N. Gassen).

The boys report another interesting finding: a half mummified fox that lies head-down across a rock in the entrance pit (Figs. 47, 48). Apparently he tried to catch a pigeon that flew from the pit and fell to his death. Heiko and Niklas also find pigeon nests, some of them still occupied by their owner, albeit in the form of skeleton or feathered mummies (Figs. 49, 50). Some nests contain collections of dead beetles (Fig. 51) 51). Bats have already occupied the pit as well, not even 20 years after this habitat became available for them.

Fig. 48: The half-mummified fox is hanging down a rock, probably where he hit after falling into the orifice of the pit. One can imagine the drama: The fox, hungry as usual, jumps at one of the pigeons leaving the pit and falls down to its demise.

Fig. 49: Pigeon skeleton in situ in its nest on lake chalk (Photo N. Gassen).

Fig. 50: Pigeon skeletons in situ and nests on lake chalk (Photo N. Gassen).

Fig. 51: Dead beetles collected in the nest-bowls (Photo N. Gassen).

We pack up and Heiko leads the expedition across some dunes before we find the track leading south to the country road to Layla. There it is prayer time, so we drive north for an hour to Hwata and look for a restaurant there. We finally find a place serving Khabsa: pieces of meat on a mountain of rice that we eagerly devour because caving (and waiting) does give you an appetite. The town lies below one of the Jurassic limestone escarpments and a road cut exposes many filled caves, a good section to return to later (23° 29.307'N; 46° 51.421'E). We finally reach home at the compound in Riyadh at 11 PM. I take a shower (after two days without water—an absolute necessity) and pack up since I have to leave the next day for home.

Stephan Kempe, Darmstadt, February 5th, 2011.

(Photo N. Gassen)

References:

Danulat, E. & S. Kempe (1992): Nitrogenous waste excretion at extremely alkaline pH: The story of Chalcalburnus tarichi (Cyprinidae), endemic to Lake Van, Eastern Turkey. - Fish Physiol. Biochem. 9: 377-386.

Kempe, S., 1994: Felsenbogen, Höhlenburg und andere Höhlen im Görtschitztal, Kärnten. - Die Höhle 45(4): 125-135.

Kempe, S., Dirks, H., 2008: Layla Lakes, Saudi Arabia: The world-wide largest lacustrine gypsum tufas. – Acta Carsologica 37(1): 7-14.

Kempe, S., Dirks, H., & Bauer, I., 2009: Hypogene karstification in Saudi Arabia (Layla Lake Sinkholes, Ain Heeth Cave). – In: Klimchouk, A., Ford, D., (eds.) 2009: Hypogene Speleogenesis and Karst Hydrogeology of Artesian Basins. - Ukrainian Institute of Speleology and Karstology, Special Paper 1, Simferopol, 247-251.

Kempe, S., Dirks, H., Bauer, I., & Rausch, R., 2009: The sinkholes of Layla Lakes; Saudi Arabia and their singular sub-lacustrine gypsum tufa. - Proc. 15th Intern. Congress of Speleology, Kerrville, Texas, July 19-26, 2009: 1556-1561.

Kempe, S., Dirks, H., Al Saud, M., Bauer, I., & Rausch, R., 2010: Hypogene Karstification and Sinkholes in the Upper Jurassic Hith Formation, Saudi Arabia. – In: Hoppe, A., Röhling, H.-G. & Schüth, C. (eds.) GeoDarmstadt2010 –Geowissenschaften sichern Zukunft, Abstracts of Lectures & Posters, 9.-14. Oktober 2010; Schriftenreihe d. Deut. Ges. f. Geowissenschafen 68: 299.

Philby, J., 1949: Two notes from Central Arabia. – The Geographical Journal, 113: 86-93.