Precision concerning the age of the Gray Sandstone at Hexen Kessel, Sperrgebiet, Namibia

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Abstract: Continued survey of the superficial deposits in the Northern Sperrgebiet, Namibia, prompts revision of previous interpretations of their ages. Fossiliferous gray calcified sandstone intercalated with travertine at Hexen Kessel was originally estimated to correlate to the Pliocene 50 metre marine package, but the 2018 field survey resulted in the discovery of stone tools *in situ* in the sand indicating the likelihood that the deposits are younger than previously envisaged. Correlation to the 30 metre marine package (Pleistocene) is possible, but some of the sandstone may represent aeolian deposits younger than this marine package. The gray sands likely represent aeolian deposits which accumulated on the flanks of the Hexen Kessel Valley where freshwater seeping to the surface cemented them with calcium carbonate. The locality has obvious archaeological interest : early hominids foraging for marine food resources, transport of raw material for manufacturing stone tools and knapping activities all focussed around freshwater springs in a hyper-arid environment.

Key words: Pliocene, Pleistocene, Stone tools, *Patella*, *Phragmites*, Namibia.

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Introduction

Gray indurated sand and travertine at Hexen Kessel were mapped by Kaiser & Beetz (1926) («esi» in their map legend) (Kaiser, 1926) and were estimated by Pickford & Senut (2016) to correlate to the Pliocene 50 metre marine package of Pether (1986, 1994; Pether *et al*. 2000). The evidence for this correlation was based on a combination of the presence of the marine gastropod *Patella* in the gray sandstone, and its occurrence at an altitude of 30 metres above sea level.

Additional survey in 2018 resulted in the discovery of information which indicates that the deposits are likely to be somewhat younger than initially concluded, and that some of them probably accumulated as part of the 30 metre marine package of Pether (1994) of Pleistocene age, whereas some may be somewhat younger. This contribution provides archeological and geomorphological data which is pertinent to understanding the age and mode of deposition of the sediments, but it does not resolve all the questions that arise from the occurrence of marine fossils associated with lithic implements in the Hexen Kessel basin. Detailed field mapping associated with archaeological investigation is required to throw more light on the subject. A pertinent question relates to the marine fossils : are they autochthonous or were they transported into the basin by early hominids?

Geological and faunal contexts

The geology of the *Patella* fossil locality at Hexen Kessel, Northern Sperrgebiet, Namibia, was described in some detail by Pickford & Senut (2016).

The eastern flank of the depression at Hexen Kessel is a steep slope eroded into Bo Alterite (deeply weathered quartzite, dolomite and schist of the Proterozoic Gariep Group) (Figs 1-5). The slope terminates abruptly upwards at an extensive erosional platform ca 30 metres above sea-level which backs onto a ridge of relatively unweathered, but folded and faulted Gariep Group rocks (Figs 1, 2). Hollows within this platform and along its western margins have been infilled with large reworked clasts of Gariep Group rocks, principally quartzite, and

planed off to the same level as the rest of the platform (Fig. 3). At the *Patella* site the gray sands do not occur on the top of the platform, but pinch out along its western margin. Locally these indurated sands drape downwards into the Hexen Kessel depression and are intercalated with layers of, and have been 'intruded' by veins of, travertine (Figs 4-5). The veins represent fissures in the sandstone and underlying basement rocks that were filled with travertine as cold carbonate-rich groundwater seeped towards the surface, precipitating calcium carbonate as it warmed up on its journey upwards to the ancient land surface. Several layers of travertine are horizontal to sub-horizontal, but others dip towards the depression, sub-parallel to its flanks. These dips are not of tectonic origin but are initial dips.

The horizontal layers of travertine suggest that at the time of their deposition the Hexen Kessel depression may have been filled with water, forming a lagoon, with a flat expanse of sandy littoral facies. In contrast, the dipping layers of travertine suggest that the depression was empty at the time of their formation with carbonate-rich water seeping out of the ground along the edge of the depression and flowing downwards into the sump below, much as it does today when the extant spring is active.

Today, there are thin patches of loose aeolian sand scattered along the flanks of the Hexen Kessel depression, representing transient sediment in a long-term aeolian transport corridor, with sand being pumped through the area from south to north (Corbett, 1989). In the past, some of this transient aeolian sediment was fixed by carbonate cement deposited by the spring waters and thereby formed the gray calcified sands that contain *Patella* shells and stone tools

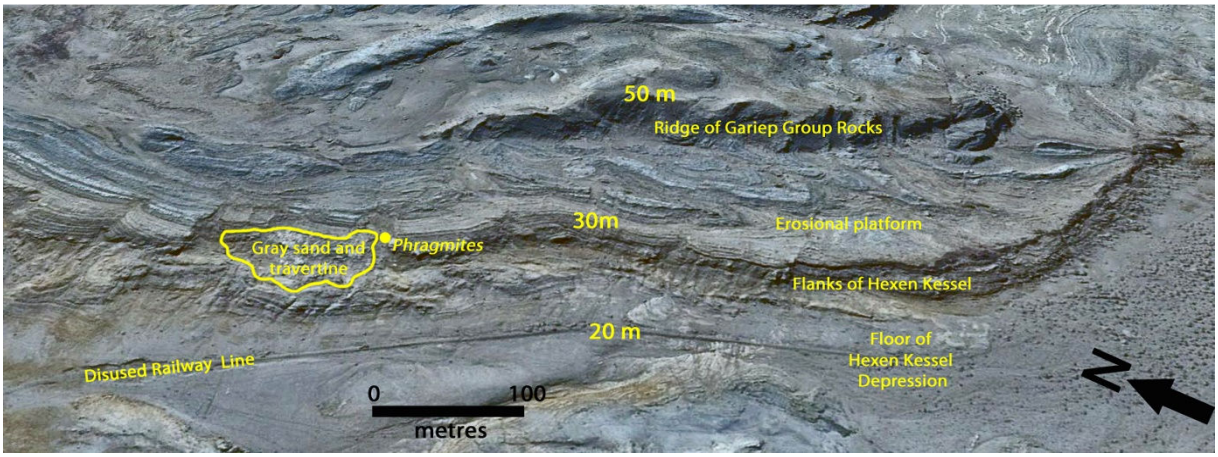

Figure 1. Oblique view eastwards of the Hexen Kessel depression and its eastern flanks. The floor of the depression is 20 metres above mean sea level (msl), the erosional platform is 30 above msl and the summit of the ridge of Gariep Group rocks is 50 m above msl. The main area of fossiliferous and implement-bearing travertine and gray sand with *Patella* is outlined in yellow and an *in situ* occurrence of *Phragmites* is indicated (image modified from Google Earth).

Figure 2. Extensive erosional platform flanking the eastern margins of the Hexen Kessel depression, Northern Sperrgebiet, Namibia, backing onto a 20 metre high ridge of relatively unaltered, folded and faulted Gariep Group rocks. View eastwards. The foreground is eroded Bo Alterite (light brown tones) exposed in the floor and flanks of the depression, and the yellow arrows show the erosional platform. Note the scatter of blocks of milky vein quartz on the present-day surface of the depression.

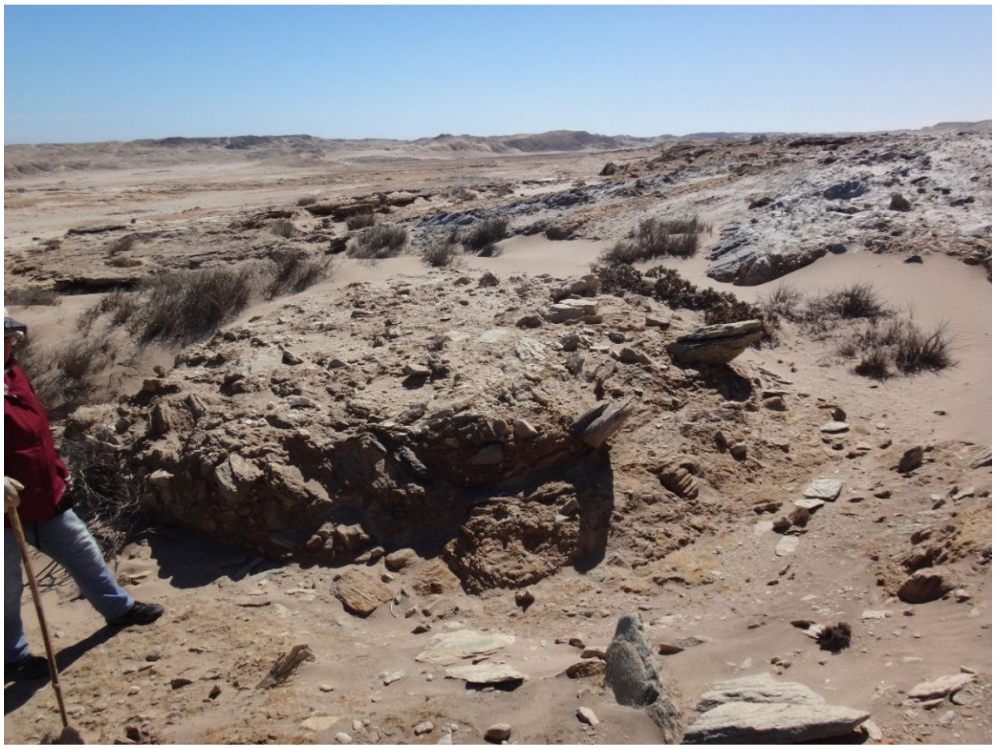

Figure 3. Small hollow in the margin of the erosional platform at Hexen Kessel, infilled with large blocks of quartzite and planed off to the same level as the platform. This remnant is surrounded by a moat-like depression eroded since it was formed, which is partly infilled with loose sand on its northern side. View northwards over the Hexen Kessel depression towards Kätchen Plateau on the horizon.

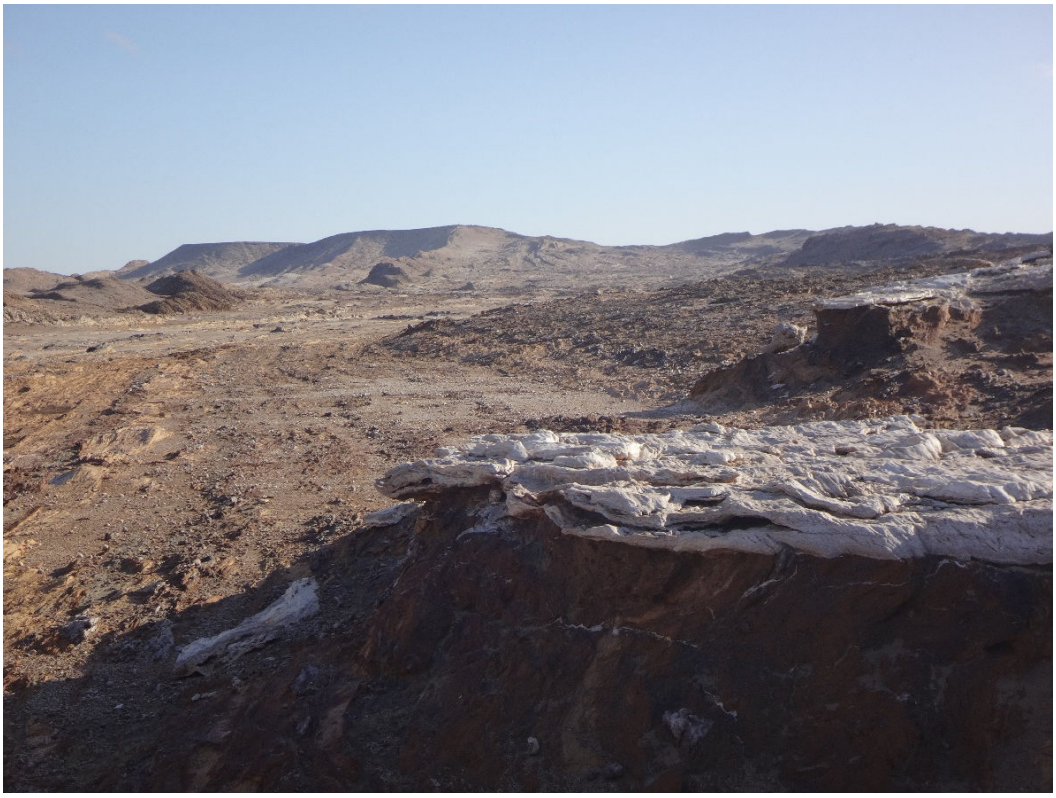

Figure 4. Flat-lying layers of travertine in the northern part of Hexen Kessel at an altitude of ca 30 masl, overlying altered basement rocks (Bo Alterite). View northwards : Elfert's Tafelberg (115 masl) in the background.

Figure 5. Intercalated travertine layers and gray sandstone dipping westwards towards the sump of the Hexen Kessel depression. These deposits overlie a thin layer of large, angular quartzite clasts (centre right of image in shadow) which in turn overlie an eroded surface of Bo Alterite (light brown tones in the foreground).

Archaeology

The raw material for the stone tools found at Hexen Kessel, comprises two lithologies, one locally available, the other allochthonous and evidently transported into the area by early hominids.

The locally available rock comprises milky vein quartz, many blocks of which scatter the surface of the ground in the vicinity of the fossil site (Fig. 2). The allochthonous material is chalcedony (chert-like micro-crystalline silica) which does not crop out locally, but which is found in abundance at Chalcedon Tafelberg 5.7 km to the north-east, and at other outcrops in the region (Pickford 2015; Pickford & Senut, 2016; Pickford *et al*. 2008).

The stone tools at Hexen Kessel *Patella* site occur preferentially near the top of the gray sandstone outcrops. There are a few specimens in the lower parts of the outcrops, but within the upper three metres of sand there are many *Patella* shells and abundant stone flakes.

The tools made from blocks of milky quartz (Figs 6, 7) tend to be roughly flaked along one side, leaving the opposite side in its natural condition, thereby forming what could loosely be called « pebble » tools (Fig. 7). The flakes detached from the blocks during the knapping process occur *in situ* in the gray sands, often with two or three flakes in close association (Fig. 6) but also as isolated flakes, indicating that their manufacture took place at the site.

The chalcedony stone tools comprise two categories : rare cores and abundant flakes (Fig. 8) few of which show signs of retouch. At three spots within the gray sand, chalcedony flakes are spatially closely associated with *Patella* shells (Figs 9-11).

As an assemblage, the stone tools at Hexen Kessel are difficult to categorise, because there are no « classic » tool types present (no hand axes, no cleavers, no backed blades, no burins, no elongate blades). The only tool types that might be formally named comprise the « pebble » tools and « flakes », but these do not indicate anything about the age of the deposits because similar implements are known to occur elsewhere in Africa from Oldowan times onwards into the Late Stone Age.

From an archaeological perspective, all that can be said about the age of the Hexen Kessel gray sand is that it is likely to be younger than 3.3 Ma, the age of the deposits at Lomekwi, Kenya, which have yielded the oldest recorded stone tools in Africa (Harmand *et al*. 2015).

The Hexen Kessel occurrence is of interest and warrants further research by archaeologists, not only with a view to determining the age of the sediments more precisely, but also because the *Patella* and oyster shells at the site possibly represent food remains left by prehistoric coastal foraging communities which exploited littoral marine resources, but which were effectively dependant for survival on freshwater springs in the interior such as Hexen Kessel (the spring is still intermittently active at present). Thus some of the marine resources appear to have been transported inland from the coast to the freshwater springs for processing and consumption. At present the Atlantic shoreline is just over 4 km from the Hexen Kessel archaeological site.

Figure 6. An assemblage of three unabraded, sharp-edged, flakes of milky quartz *in situ* in gray sand at Hexen Kessel *Patella* site (scale : 8 cm).

Figure 7. Stereo triplet of a « pebble » tool in milky quartz excavated from the gray sand at Hexen Kessel, showing the sharp cutting edge of the tool, the opposite side being the natural surface left as found (scale : 8 cm).

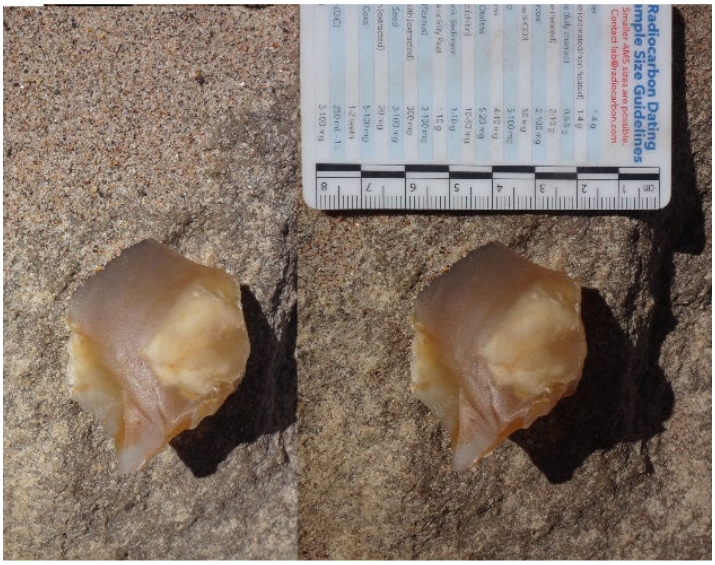

Figure 8. Stereo views of an unabraded flake of chalcedony *in situ* in carbonate-cemented gray sand at Hexen Kessel *Patella* site (scale : 8 cm).

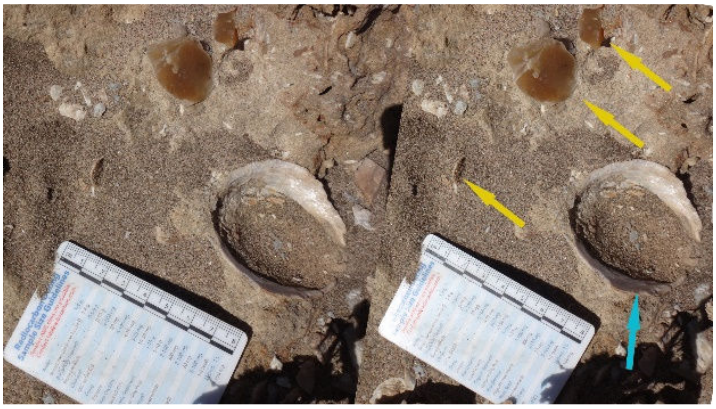

Figure 9. Stereo images of three flakes of chalcedony (yellow arrows) *in situ* in cemented gray sand at Hexen Kessel, associated with a shell of *Patella* (blue arrow) (scale : 8 cm).

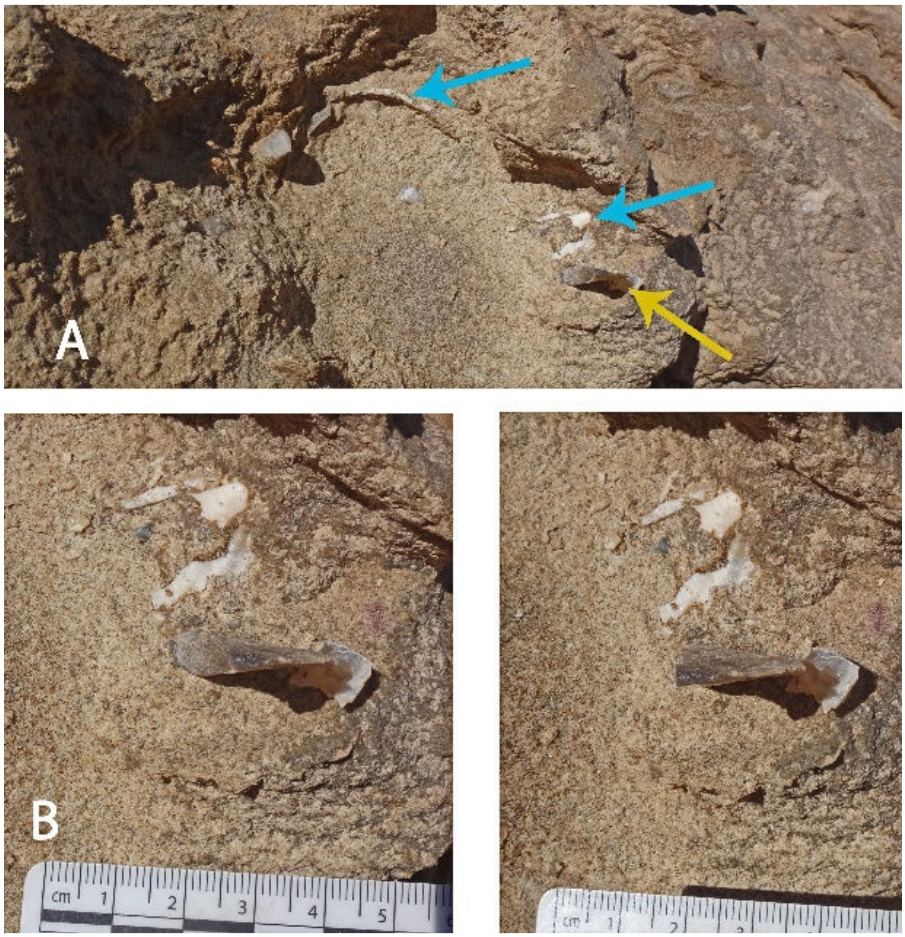

Figure 10. Two *Patella* shells (blue arrows) associated with a chalcedony flake (yellow arrow) *in situ* in indurated gray sand at Hexen Kessel, Sperrgebiet, Namibia. A) view of complete ensemble ; B) stereo view of lower part of assemblage (scale : 8 cm).

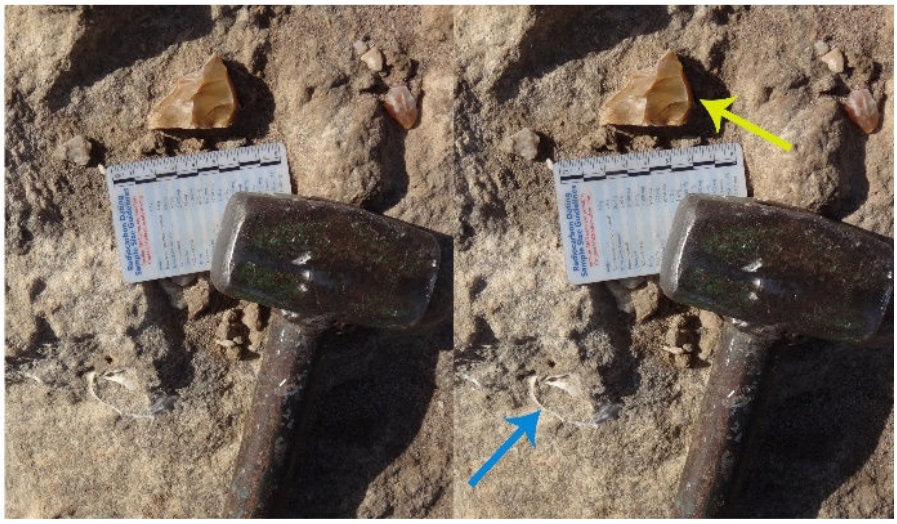

Figure 11. Stereo views of *Patella* shell (blue arrow) associated with a flake of chalcedony (yellow arrow) *in situ* in cemented gray sand at Hexen Kessel, Sperrgebiet, Namibia (scale : 8 cm).

Discussion

On the basis of the presence of stone tools in the fossiliferous gray sandstone at Hexen Kessel, the deposits appear to be younger than previously thought : latest Pliocene or younger.

The lithic implement assemblage is lacking in diagnostic tool types, meaning that with currently available information, it is not possible to propose a more precise age estimate. Correlation with the Pleistocene 30 metre marine package (Pether, 1994) is possible because the deposits are banked up against the flanks of the Hexen Kessel depression which is locally bordered by an extensive erosional platform 30 metres above mean sea-level, but it is also possible that the calcified sands are younger than the 30 metre marine package.

Some of the travertine layers that are intercalated in the gray sandstone dip towards the sump of the Hexen Kessel depression in a similar way to the travertines at Gamachab (Pickford, 2015) and at Kaukausib (Pickford & Senut, 1999) where they form dome-shaped outcrops, and are rather different from the extensive, flat-lying sheets of travertine that occur at Elisabethfeld and Grillental which are associated with the 30 metre marine package (Corbett, 1989). In the Gamachab and Kaukausib outcrops, the gray sands are of aeolian origin, and were fixed in place by carbonate cement brought into the area by groundwater springs. The same process appears to have been active at Hexen Kessel, but it is not impossible that some of the flat-lying travertine layers in the area could be related to a lagoon which formerly filled the Hexen Kessel depression up to the level of the extensive erosional platform that flanks its eastern margin.

Detailed mapping is required to settle the issue but a composite genetic model seems likely on the basis of currently available evidence, with some deposits related to a lagoonal environment representing an earlier phase of deposition comprising :- 1) *Phragmites* in growth positions (Pickford & Senut, 2016), 2) coarse infilling of depressions in the erosional platform which have themselves been planed off, and 3) flat-lying travertine layers, followed by a later phase of deposition when the Hexen Kessel depression was empty, during which aeolian sands on the flank of the basin were cemented by groundwater rich in carbonate, and during which inclined layers of travertine were deposited.

The stone tools at Hexen Kessel appear to be related to the earlier phase of deposition, but detailed mapping is required to confirm or refute this possibility.

The fact that most of the occurrences of travertine in the Northern Sperrgebiet (Elisabethfeld, Kaukausib, Gamachab, Hexen Kessel) are close to springs that are still active at the present day (albeit intermittently) suggests that they were emplaced during a more humid and probably cooler climatic phase than the present day hyper-arid climatic regime.

Conclusions

The fossiliferous gray sands at Hexen Kessel are likely to be younger than previously thought. Correlated by Pickford & Senut (2016) to the 50 metre marine package of Pether (1994) which is considered to be of Pliocene age, the deposits are likely to be younger than 3.3 Ma, the age of the oldest known stone tools in Africa (Harmand *et al*. 2015). Correlation of the flat-lying travertine sheets at Hexen Kessel to the 30 metre marine package of Pether (1994) is possible, but the possibility also exists that the sands and associated travertine might post-date this event, in which case they could be Middle Pleistocene or younger.

The presence of inclined sheets of travertine dipping towards the sump of the Hexen Kessel depression invites correlation to similar deposits at Gamachab and Kaukausib (Corbett, 1989).

There appears to have been a phase (or phases) of travertine deposition in the Northern Sperrgebiet during the Pleistocene which took place at about the time of deposition of the 30 metre marine package of Pether (1994) and subsequently, and which was localised at freshwater springs not far from the present-day Atlantic coastline.

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