

Final Report – Middelburg Field Work  
Middelburg Local Municipality, Eastern Cape Province  
Farms: Brand Vallei 31, Schoongesicht 43, Drooge Fontein 42, Vrees Fontein 44, Vries Fontein 40,  
Klippe Rif 112, Soutpansdrift 198  
Fourie, H. Dr  
DITSONG: National Museum of Natural History  
P.O. Box 413  
Pretoria  
0001  
012 322 7632  
hfourie@mitsong.org.za

### **Executive summary**

Outline of project: The focus of the project was the Groot Brak River that flows in a north-southerly direction from the Suurberg to the Grassridge Dam. It is located between Steynsburg and Middelburg at the small town of Schoombe on the R56 road in the Middelburg Local Municipality, Eastern Cape Province. The project commenced in March 2005 and concluded in May 2015 and the aim was to remove and collect fossils as part of an investigation of possible new localities and remove fossils located in the riverbed that may be washed away during the rainy season.

### Outline of the geology and Palaeontology:

The alluvium, calcrete and colluvium (m) is Quaternary in age. Over areas totalling fully 40% of Southern Africa the 'hard rocks', from the oldest to the Quaternary, are concealed by normally unconformable deposits – principally sand, gravel, sandstone, and limestone. Inland deposits are much more extensive than marine deposits and are terrestrial and usually unfossiliferous. Some of these deposits date back well into the Tertiary, whereas others are still accumulating. Owing to the all-too-often lack of fossils and of rocks suitable for radiometric or palaeomagnetic dating, no clear-cut dividing line between the Tertiary and Quaternary successions could be established (Kent 1980). The alluvium sands were deposited by a river system and reworked by wind action (Snyman 1996).

The Tarkastad Subgroup is Early Triassic in age and conformably overlies the Adelaide Subgroup. Sandstone predominates and 'red' mudstone is more abundant above the contact of the two subgroups. It is divided into the lower sandstone-rich Katberg Formation and an upper mudstone dominated Burgersdorp Formation. The capping on top of the Koffiebus and Teebus koppies just below the dolerite sill is the Burgersdorp Formation (Cole *et al.* 2004).

The *Lystrosaurus* Assemblage Zone includes the Palingkloof Member (uppermost member of the Balfour Formation), the Katberg Formation and the lower third of the Burgersdorp Formation of the Tarkastad Subgroup, Beaufort Group, Karoo Supergroup. It is Early Triassic (230-195 million years), Mesozoic in age (Rubidge 1995).

Summary of findings:

Table 1: Table of finds.

<b>Field no.</b>	<b>Catalogue no.</b>	<b>Date</b>	<b>Locality</b>	<b>Genus</b>
HF3/2006/1	TM5043	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF3/2006/2	TM5044	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF3/2006/3	TM5045	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF3/2006/4	TM5046	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF3/2006/5	TM5047	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF3/2006/6	TM5048	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF3/2006/7	TM5049	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF3/2006/8	TM5050	2006/07/01	Klippe Rif	<i>Procolophon</i>
HF1/2005/4	TM5051	2005/3/28	Drooge Fontein	Dicynodontia
HF1/2006/1	TM5052	2006/9/9	Drooge Fontein	<i>Lystrosaurus</i>
HF2/2005/1	TM5053	2005/3/27	Donated	Therapsid
HF1/2005/1	TM5054	2005/3/28	Drooge Fontein	<i>Galesaurus</i>
HF1/2005/2	TM5055	2005/3/28	Drooge Fontein	<i>Lystrosaurus</i>
HF1/2005/3	TM5056	2005/4/1	Drooge Fontein	<i>Therocephalia</i>
HF1/2005/5	TM5057	2005/3/28	Drooge Fontein	Therapsid
HF1/2005/6	TM5058	2005/4/2	Drooge Fontein	<i>Lystrosaurus</i>
HF1/2005/7	TM5059	2005/4/1	Drooge Fontein	Dicynodontia
HF1/2005/8	TM5060	2005/3/28	Drooge Fontein	Dicynodontia
HF1/2005/9	TM5061	2005/4/2	Drooge Fontein	<i>Lystrosaurus</i>
HF4/2005/1	TM5062	2005/3/30	Schoongesicht	Dicynodontia
HF1/2005/10	TM5063	2005/3/28	Drooge Fontein	Therapsid?
HF5/2007/1	TM5064	2007/5/7	Brand Vallei	<i>Sauropareion</i>
HF5/2007/2	TM5065	2007/5/7	Brand Vallei	<i>Sauropareion</i>
HF1/2007/1	TM5066	2007/5/6	Drooge Fontein	Therapsid

HF4/2009/1	TM5067	2009/4/12	Schoongesicht	Therapsid
HF4/2009/2	TM5068	2009/4/12	Schoongesicht	?
HF1/2009/1	TM5069	2009/4/10	Drooge Fontein	?
HF6/2010/1	TM5070	2010/5/25	Mt Melsetter	<i>Lystrosaurus</i>
HF1/2010/1	TM5071	2010/5/20	Drooge Fontein	<i>Lystrosaurus</i>
HF1/2010/2	TM5072	2010/8/21	Drooge Fontein	<i>Lystrosaurus</i>
HF1/2013/1	TM5074	2013/10/23	Drooge Fontein	Dicynodont
HF7/2013/1	TM5075	2103/10/23	Riverside	Procolophonid
HF1/2015/1	TM5076	2015/5/18	Drooge Fontein	Dicynodontia
HF4/2015/1	TM5077	2015/5/18	Schoongesicht	Dicynodontia
HF4/2015/2	TM5078	2015/5/18	Schoongesicht	Dicynodontia

The Palingkloof Member is not present in the study area, but the Tarkastad Subgroup (Katberg Formation) is and due to the presence of *Lystrosaurus*, *Procolophon trigoniceps* and *Galesaurus planiceps* it is likely to be the *Lystrosaurus* Assemblage Zone.

#### **Background Information on the project**

Outline of the project: The focus of the project was a 45 km section of the Groot Brak River that flows north-south from the Suurberg into the Grassridge Dam. The project commenced in March 2005 and concluded in May 2015 and the aim was to remove and collect fossils as part of an investigation of possible new localities (good outcrops) and remove fossils located in the riverbed that may be washed away during the rainy season.

The length of the river was walked and localities were recorded. In total seventeen farms were visited. Geological features were photographed. The mudstone-pebble conglomerate was found to be rich in micro-and macrofossils. Most of the excavated fossils are from the blue-grey and red/maroon/purple mudstone. *Lystrosaurus sp.* is the most abundant. Both crania and postcrania are present.

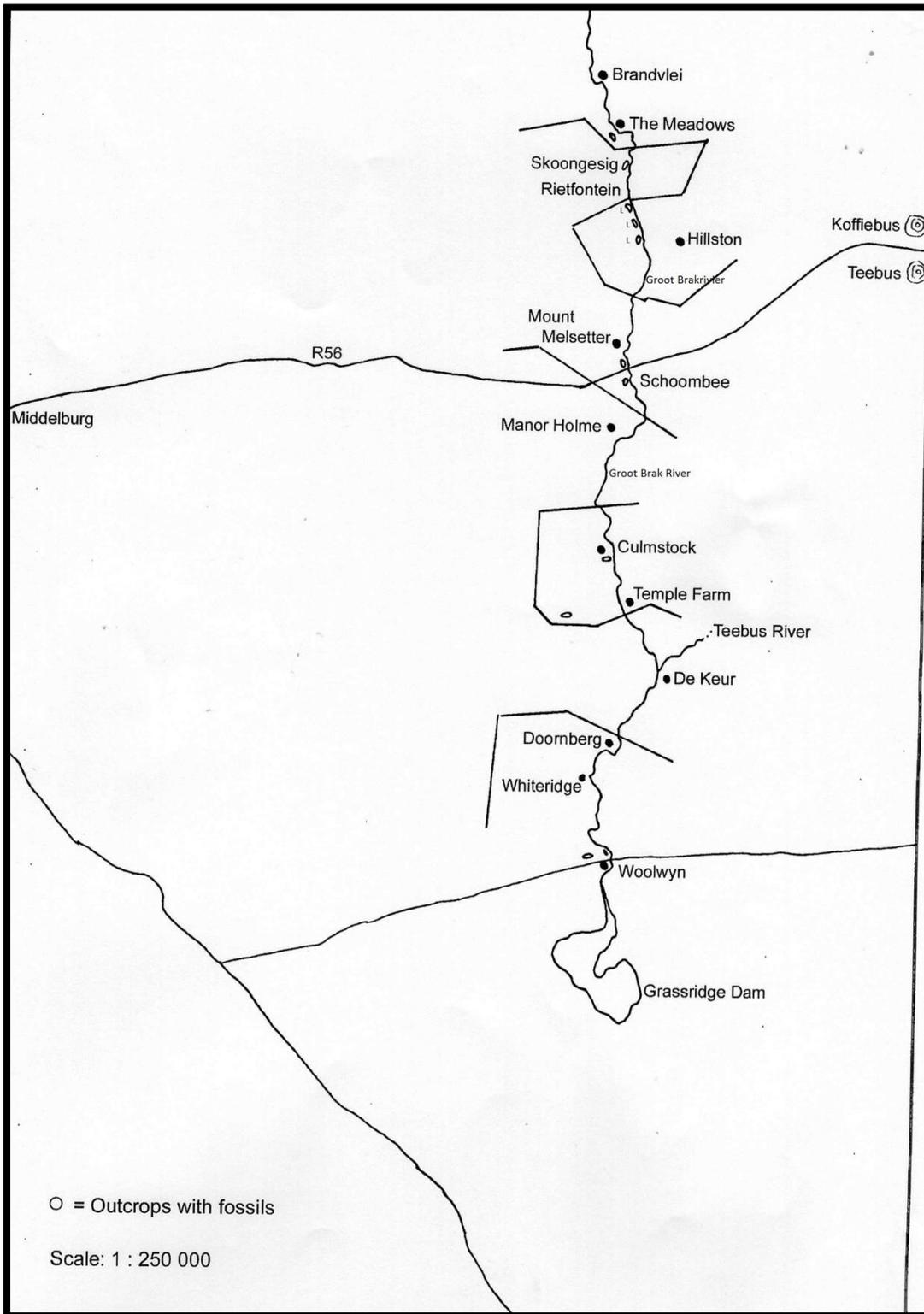
#### **Description of the property**

Location and depth: The study area is present in the southeastern part of the basin. Some of the fossils present here have survived the end-Permian extinction event and are also proof of the supercontinent of Gondwana. The belated Professor J.W. Kitching (University of the Witwatersrand) visited this area during the seventies. It is located midway between Steynsburg and Middelburg at the small town of Schoombee on the R56 road in the Middelburg Local Municipality, Eastern Cape Province. The lowest point of the study area is 1139 m above sea level and the highest point is 2076 m at the top of the Suurberg. Some of the dongas were up to 3 m deep.

Figure 1: Google.earth image of the location of the Groot Brak River.



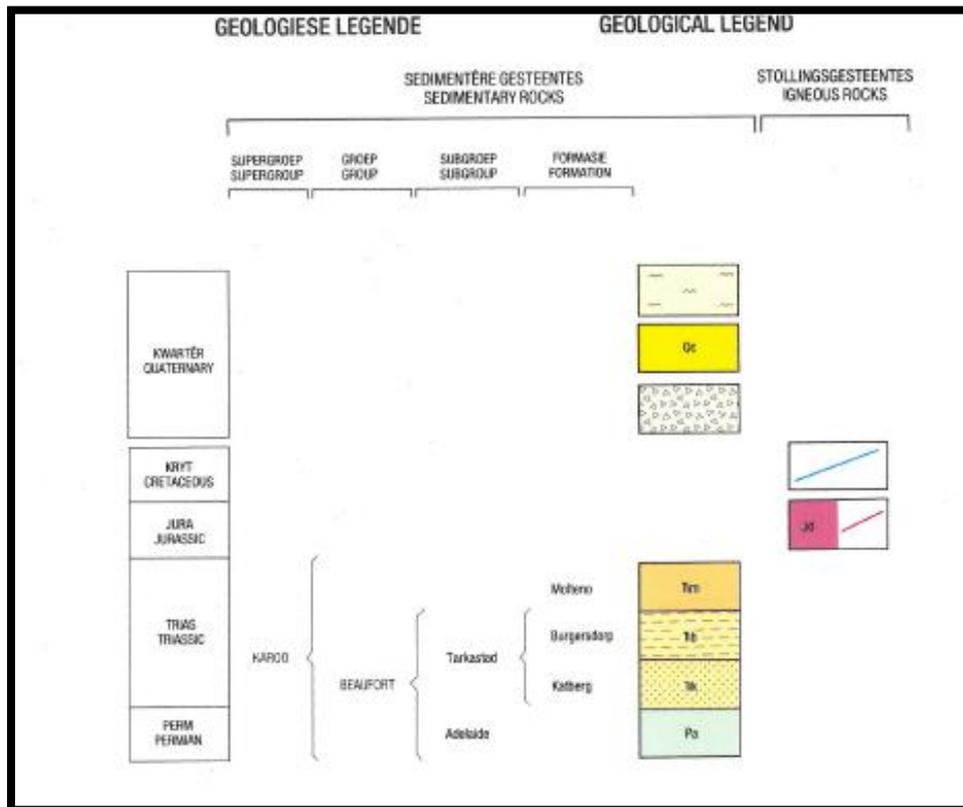
Figure 2: Diagram showing river and farm locations (drawn by H. Fourie).



### Name and geographical location of the site

Lithostratigraphy: The *Lystrosaurus* Assemblage Zone correlates with the Palingkloof Member (uppermost member of the Balfour Formation), the Katberg Formation and the lower third of the Burgersdorp Formation of the Tarkastad Subgroup, Beaufort Group, Karoo Supergroup. It is Early Triassic (230-195 million years), Mesozoic in age (Rubidge 1995).

Figure 3: Lithostratigraphic column (Muntingh 1997).

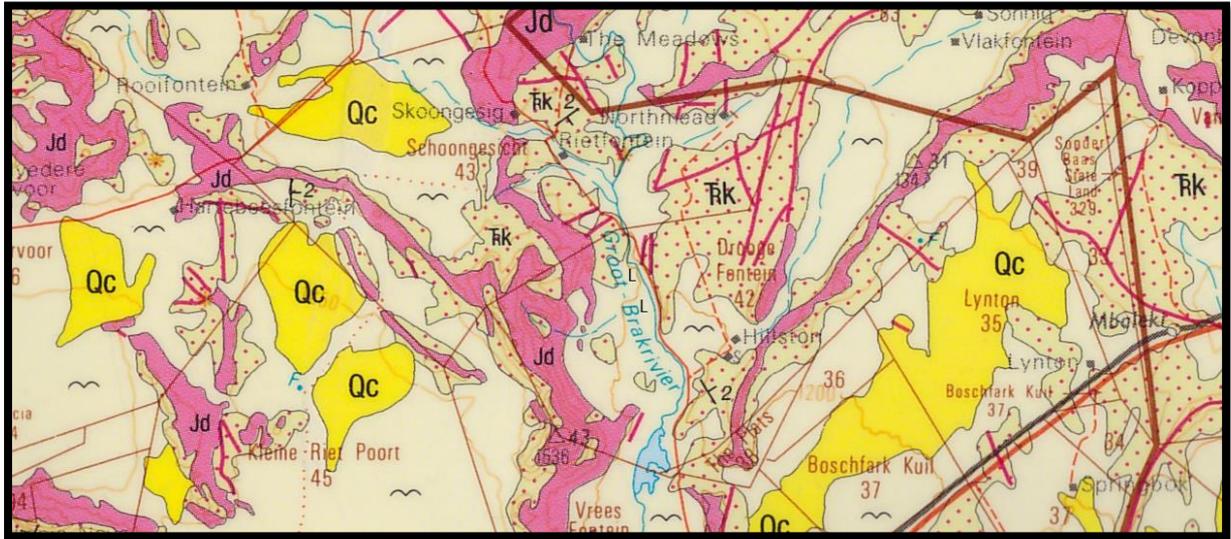


Biostratigraphy: *Lystrosaurus* Assemblage Zone. It overlies the *Dicynodon* Assemblage Zone and underlies the *Cynognathus* Assemblage Zone. *Lystrosaurus* is the most common fossil genus present in this zone. Three *Lystrosaurus* species are found in this biozone, namely *L. curvatus*, *L. murrayi* and *L. declivis*.

Farms: Brandvlei (Brand Vallei 31), Rietfontein (Scoongesicht 43) Hillston (Drooge Fontein 42), Mount Melsetter (Vrees Fontein 44), Schoombee (Vries Fontein Annex 40), Temple Farm (Klippe Rif 112) and Woolwyn (Soutpansdrift 198). Other farms visited, namely Skilderkrans (Schilder Krans 32), The Meadows (Vlakfontein 83), Manor Holme (Varkenskop 101), De Keur (De Kuur 194), Doornberg and Whiteridge (Soutpansdrift 198). Bulhoek (Rocklyn 79), Middelwater (Middelwater 138), Ridgewater (Bulle Fontein 96) and Ezelshoek (Jagt Poort 301) were also visited.

The Groot Brak River is located between Steynsburg and Middelburg at the small town of Schoombee on the R56 road in the Middelburg Local Municipality, Eastern Cape Province.

**Figure 4:** Map 3124 Middelburg (1: 250 000) to show location of farms north of the R56 road (Muntingh 1997).



*Legend and Explanation*

- m – Alluvium, colluvium (beige), Quaternary in age.
- Qc – Calcrete (yellow) – Quaternary.
- Rk – Fine-grained sandstone and red and green-grey mudstone (yellow with red dots) - Katberg Formation, Tarkastad Subgroup, Beaufort Group, Karoo Supergroup.
- Jd – Dolerite (pink) - Karoo dolerite.
- ↘2 – Strike and dip of strata / sills, dip in degrees.
- L – Fossil Localities on Hillston.

Geology of the area: The alluvium and colluvium (m) as well as the calcrete (Qc) are Quaternary in age. Over areas totalling fully 40% of Southern Africa the ‘hard rocks’, from the oldest to the Quaternary, are concealed by normally unconformable deposits – principally sand, gravel, sandstone, and limestone. Inland deposits are much more extensive than marine deposits and are terrestrial and usually unfossiliferous. Some of these deposits date back well into the Tertiary, whereas others are still accumulating. Owing to the all-to-often lack of fossils and of rocks suitable for radiometric or palaeomagnetic dating, no clear-cut dividing line between the Tertiary and Quaternary successions could be established (Kent 1980). The alluvium sands were deposited by a river system and reworked by wind action (Snyman 1996). The Cenozoic cover is generally thin and consists of a variety of hillslope and alluvial deposits (Cole *et al.* 2004).

The southern part of the Karoo basin is 3000 m thick, but the northern part of the basin is much thinner. The animals present during Beaufort times flourished on the floodplains, lakes and marshes. Sandstone is deposited in times of flooding in the river channels and the mudstones were deposited on the floodplains in the shallow lakes. The Katberg Formation (Rk) is a sandstone body, 1000 m in thickness (Snyman 1996).

The Beaufort Group consists of greenish-grey, bluish-grey or red mudstones. Sandstones are often cross-bedded. Deposition is mainly terrestrial, river-dominated. Two subgroups are distinguished, the upper Tarkastad- and the lower Adelaide Subgroups. The Tarkastad Subgroup possesses a

greater abundance of both sandstone and red mudstone. The base of the Katberg Formation divides the two subgroups (Kent 1980). The Adelaide Subgroup is not present in the study area.

The Tarkastad Subgroup is Early Triassic in age and conformably overlies the Adelaide Subgroup. Sandstone predominates and 'red' mudstone is more abundant above the contact of the two subgroups. It is divided into the lower sandstone-rich Katberg Formation and an upper mudstone dominated Burgersdorp Formation. It is characterised by arid conditions with seasonal rainfall and extended drought periods. The capping on top of the Koffiebus and Teebus koppies just below the dolerite sill is the Burgersdorp Formation (Cole *et al.* 2004).

The Burgersdorp Formation has been interpreted as deposits of meandering channels containing muds (red) and silts with argillaceous nature. Minor sandstone bodies are present and are buff weathered grey, greenish grey and light-olive grey (Cole *et al.* 2004). The Katberg Formation caps the Sneeuberg and is sandstone-dominated. The basal unit is the mudstone-pebble conglomerate (channel lag) with bone fragments and calcareous nodules and is arenaceous in nature. The mudstones are predominantly greenish grey, grey to dark grey, olive grey and less commonly reddish (Cole *et al.* 2004).

Jurassic dolerite (Jd) is abundant. Dish-shaped dolerite structures are especially prominent (Cole *et al.* 2004).

**Figure 5:** Section in the donga at Hillston (photograph by M. Moore).



The succession in the dongas is made up from the top of yellow sandstone, mudstone-pebble conglomerate (channel lag), greenish-grey siltstone, bluish-grey and maroon mudstones at the base. These indicate drought conditions as the fossils are well-preserved, often with associated postcrania.

Field observations

**Figure 6:** Features such as ripples, raindrops, mudcracks, rib and furrow, infill cracks and gas bubbles are present. Here above, ripple marks and gas bubbles (H. Fourie).



**Figure 7:** Photograph that shows a possible burrow in a channel at Hillston (H. Fourie).



**Figure 8:** Photograph of a desert rose (photograph S. Dippenaar).



Sedimentary structures identified are horizontal lamination, ripple cross-lamination, cross bedding, mudcracks, caliches, dykes, burrows, root marks, rib-and-furrow structures and mottling. Infilled desiccation cracks are common on Skoongesig, Mt Melsetter and Woolwyn and indicate periodic exposure and drying out of shallow ponds on the floodplain. Current-rippled surfaces are present on most farms and display flow directions of south-southwest, south-southeast and north-northeast directions as well as being symmetrical indicative of wind action.

**Figure 9:** Photograph of mudcracks (H. Fourie).



The Palingkloof Member is not present in the study area, however, the Tarkastad Subgroup (Katberg Formation) is and due to the presence of *Lystrosaurus*, *Procolophon trigoniceps* and *Galesaurus planiceps* it is likely to be the *Lystrosaurus* Assemblage Zone.

**Figure 10:** Locality next to road at Brandvlei where the two *Sauropareion* sp. skulls were found (H. Fourie).



**Figure 11:** Most localities resemble each other. This is at Woolwyn in the south (H. Fourie).



**Background to Palaeontology of the area**

The fossils mainly occur in the maroon mudstone and to a lesser extent in the blue mudstone. The channel-lag at the top, just below the yellow sandstone contains plenty of bone fragments and microfauna. Crania were found to be upside down on The Meadows, Skoongesig and Mt Melsetter.

Burrows on Skoongesig contained Therocephalian skeletons. The burrows are non-branching, large or small, slightly curving, and terminate blunt. Invertebrate burrows were recorded on Brand Vlei, Hillston and Woolwyn.

**Figure 12:** Two Therocephalia? in a burrow (H. Fourie).



Fossils that may occur in the *Lystrosaurus* Assemblage Zone are:

Amphibia such as *Broomulus*, *Lydekkerina*, ect., reptilian such as *Procolophon trigoniceps* and other Eosuchia, Therapsids such as *Lystrosaurus*, *Erciolacerta parva*, *Regisaurus jacobi*, *Olivieriasuchus parringtoni*, *Galesaurus planiceps*, and *Thrinaxodon liorhinus*. It is not uncommon to find invertebrates, plant fossils and trace fossils.

*Lystrosaurus declivis* is the most abundant fossil found in the study area. It has a snout that is notably longer than the length of the skull roof. *Procolophon trigoniceps* is found as impressions on Temple Farm and *Sauropareion anoplus* is found at Brandvlei as a true fossil. The cynodont *Galesaurus planiceps* was found on Hillston.

Fossils were found on farms as listed in Table 1. During the site visits no fossils were found on Manor Holme, Skilderkrans and Ridgewater.

### **Description of work**

The objective was to map the fossil localities within the Groot Brak River. A project started in 2005 and which has yielded 35 fossils. Fossils were also located at Hillston on the koppies next to the river. Plenty of root casts, infill structures, raindrop, ripples, and burrows are present. Skulls are found mostly in an east-west facing direction and are mostly found dorsal side up.

Extensive exposures of the Beaufort Group strata in the Groot Brak River contain vertebrate fossils of mostly the genus *Lystrosaurus* sp. It is Early Triassic *Lystrosaurus* Assemblage Zone in age. Jurassic dolerite is abundant as dyke and sill intrusions. Fossils are well preserved, often with articulated skeletons. This matrix does not prepare easily as it is flaky and well weathered.

One fossil was excavated at Hillston during the 2013 field season. It is a small partial *Lystrosaurus* skeleton belonging to the Dicynodontia, Synapsida, Amniota. Part of this fossil was left behind as it continues into the heavy embankment. The part excavated was in such a position that the next flood would have destroyed it or have carried it downstream (GPS location S 31° 23' 356" E 25° 28' 577"). Altogether, this locality has yielded 15 Dicynodont fossils, 11 Parareptilia, one Cynodont, one Therocephalia and five Therapsid fossils. So far fossils from the other taxonomic groups, such as amphibia have not been found in the study area.

### **Methodology**

Traditional excavation methods were used. The fossil present in the rock is cleaned with a brush to see the extent. It is then photographed and parts that are brittle are covered with plaster of Paris to avoid breaking off. A geological pick and several sized chisels are used to free the specimen with matrix attached. The fossil will be prepared in the laboratory with a Desoutter air-scribe using tungsten tips. The survey of the area was done on foot and photographs were taken with a digital Canon camera (PowerShot A470) in 7.1 mega pixels. Additionally Google.maps and Google.earth were accessed on a Sony Xperia cellular phone. A Global Positioning System (GPS) (Garmin eTrex 10) was used to record fossil finds and outcrops.

**Figure 6:** An example of an *in situ* fossil in the riverbed at Hillston.



There are three areas on Drooge Fontein where fossils are abundant and it is worthwhile to revisit the riverbed as the river is known to flood annually.

**Name of institution curating material**

DITSONG: National Museum of Natural History. All specimens are assigned the prefix of TM (formerly Transvaal Museum). The Field number of HF\_/20\_\_/\_ were assigned.

**References**

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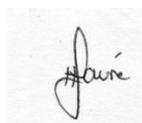
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**Permit number**

80/05/03/001/60, 80/06/03/007-011/61, 80/08/12/005-010/61 and 80/12/02/009/61 Exp 01/08/2015



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Heidi Fourie  
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