**Nature of the Project**

This project seeks to study biological characters of mass extinction events and the link between environmental parameters and ecosystems. This is taking place in a climate of interest in lesser extinction events (i.e. other than the big 5 of Raup and Sepkoski [1982]) and the effects of extinction events on the course of evolution, both in terms of life history and evolutionary dynamics. The Capitanian extinction in particular has been subject to research for its clear temporal link with the Emeishan Large Igneous Province of southern China. Most of the work has focused on the timing and chronology of the volcanics and the patterns of extinction in marine faunas, but many uncertainties remain (Bond et al. 2010; Bond and Wignall, 2014; Jost et al. 2014; McGhee et al. 2013; Shellnut e al. 2012; Wignall et al. 2009; Zhong et al. 2014). In particular, while the global disappearance of certain marine taxa is supported, the impact on terrestrial ecosystems is not clear. Through fossil collecting, broad database analyses and geochronological work we have started to show that terrestrial tetrapod ecosystems were subject to significant generic turnover at this time. Now, we wish to further consider the mode by which tetrapod communities were modified, while the nature of climatic changes in the Karoo and changes in plant ecosystems need to be addressed. This requires stratigraphically well constrained fossil data that can only be obtained by rigorous stratigraphic collecting.

This forms part of a long-term project run by Dr M. Day and Prof. B. Rubidge at the Evolutionary Sciences Institute (formerly BPI) in vertebrate biostratigraphy and diversity in the Middle Permian and Middle-Late Permian transition. This has involved targeted, stratigraphic collecting in the Western, Eastern and Northern Cape provinces, as well as the Free State. More recently, our focus has narrowed on the upper Abrahamskraal Formation and lower Middleton Formation, which is biostratigraphically equivalent to the *Tapinocephalus* and *Pristerognathus* Assemblage Zones (AZ; see biozone map in additional documents) and corresponds to the global marine Guadalupian-Lopingian boundary (approximately 260 million years ago) and its vicinity. This encompasses the extinction of dinocephalian therapsids at the top of the *Tapinocephalus* AZ but we have also begun working up to the lowest part of the *Tropidostoma* AZ in order to provide some data about recovery from the end-*Tapinocephalus* AZ extinction.

Our collecting for the foreseeable future will bolster fossil datasets and add data to strategic parts of the stratigraphy and to strategic parts of the basin to explore geographic as well as temporal patterns. We are also now endeavouring to collect environmental proxy data to study potential influences on tetrapod ecosystems.

**Geological formations applicable to this application:**

1. Abrahamskraal Formation
2. Middleton Formation

The Abrahamskraal Formation is the lowest of the Beaufort Group. The formation was deposited in the Middle Permian (Wordian and Capitanian stages) and its upper boundary is close to the Middle-Late Permian boundary. The upper boundary of the formation appears to be relatively contemporaneous around the basin, but the lower contact is highly diachronous (Modesto et al. 1999; Rubidge et al. 2001; Welman et al. 2001). In the south-west of the Karoo Basin, in the Western Cape Province, the Abrahamskraal Formation reaches up to 2550m thick, but elsewhere, such as in the Victoria West district of the Northern Cape Province, is as little as 100 thick, reflecting the movement of the palaeoshoreline into the basin from the south. The definition of the Abrahamskraal Formation used here includes the Koonap Formation in the Eastern Cape Province, in accordance with a recently made but as yet unpublished decision by the South African Committee for Stratigraphy. The Abrahamskraal Formation extends in an arc from East London west to Laingsburg in the Western Cape Province and then northeast to the vicinity of De Aar in the Northern Cape Province.

The overlying Middleton Formation is of early Late Permian age (Wuchiapingian stage) and extends from East London west to Fraserburg in the Western Cape Province (where is referred to as the Teekloof Formation) and then northeast into the south-western Free State after which it becomes difficult to identify.

To see the areas that are of interest, see the attached biozone map (*Tapinocephalus*, *Pristerognathus* and lower *Tropidostoma* AZ) and more general geographical map in Google Earth showing area of interest in relation to provincial boundaries.

**Fieldwork**

This application is intended to obtain a permit to cover collecting in the Abrahamskraal and Middleton Formations of the Beaufort Group in the Northern Cape and Free State provinces. We also intend to collect in the Western and Eastern Cape provinces but these will be addressed separately to the relevant provincial authorities as discussed with SAHRA. As part of a long-term collecting project, our field seasons vary from year to year depending on the direction the project is taking at the time and, therefore, we do not have a long-term itinerary.

For the year 2015 we would like to collect in the following District Municipalities:

Namakwa and Pixley ka Seme (old Sutherland, Fraserburg and Victoria West districts)

Although specific farms have been requested by SAHRA, this information is not yet available. (see below). However, we will of course be prepared to share this information with SAHRA when available.

**Landowner Permission and farms**

As has been discussed at length between the palaeontological community and SAHRA, the kind of fieldwork we conduct makes the obtaining of landowner permission prior to fieldwork extremely difficult. Often we make use of a known farmer in the area of interest and obtain phone numbers for those farmers who own land in an area of interest, but we usually have to meet people in person before we are given permission to work there. Because of the great distance between Johannesburg and the Great Karoo, this of course makes the obtaining of permission prior to fieldwork prohibitively expensive, both in terms of money and time. We also rely on geological maps to decide on potential field sites but often we can only identify large areas and are only able to determine the best sites when in the field.

We always obtain permission before collecting on a farmer’s land and in general we have found farmers very friendly and accommodating; however, they are suspicious of unknown people from universities in light of fracking in the Karoo, and are unlikely to sign paperwork. This is especially so for us in a project such as this one where we often work in new places and therefore do not have the opportunity to build up long-term relationships with individual farmers. Because of the broad scope of this project, we therefore can provide neither advance lists of farms that we will visit nor permission from farmers.

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