

End Of Summer Report FURSCA

Introduction

This interdisciplinary research project will investigate the sedimentology and stratigraphy of the Cretaceous Morondava Basin of western Madagascar (approximately 80 million years ago) through multiple sources. First, I will translate descriptions of the geology of the Morondava Basin from French to English, using detailed literature from field expeditions in the 1960s through 1980s (Besairie, 1967 and 1972; Razafimbelo, 1987). I will use those translated descriptions to draft stratigraphic sections. I will also correlate these sections with sections and data that Dr. Marshall collected in the field in 2012 and 2015. Through this research, I will refine the regional context for the interpreting and reconstructing paleoenvironments that host significant fossils from the Cretaceous of western Madagascar during the time it was separating from surrounding continents and becoming an island (Geiger et al., 2004). This is important because reconstructing ancient environments of a whole basin requires data from numerous locations, which is challenging to accomplish when doing fieldwork today due to the difficulties of travel to remote parts of Madagascar, political instability, and the grasslands covering the rocky landscapes of interest.

Summary

This was a very enthralling experience for me. My findings with my work and the experiences I gained are binded. I was able to translate and construct stratigraphy sections based on the works of Henry Besairie, his work from 1972. Along with the interpretations I was also able to see growth with the translations. Another learning factor with this research is that I learned that scientific french and regular day-to-day french are somewhat different. For example, scientific french was more direct and repetitive while the regular day-to-day seemed to be more complex and dynamic french. It being repetitive made it a lot easier to understand and be able to make connections with the areas I was reading about. Hardship was evident when I came across certain terms that Besairie used when translated to English and didn't make sense. There were also areas with minimal text and those are the areas luckily Dr. Madeline Marshall had researched in so I have very good information on those areas that were left out. These were the times I was able to utilize my two research advisors. They help with the clarifications and I was able to learn a lot about the art of translation.

Overall I am on the right track of achieving my goals with this research, however, for the most part, I was able to translate and construct detailed stratigraphy sections which will be very important in the next part which is correlating all the sections and formulating interpretations. I plan on doing interpretations with system tracts using the facies that were evident to tell a detailed and refining the regional context on the paleoenvironments that host significant fossils. The next steps of this research are to complete correlations and paleoenvironmental

interpretations and also getting more translations done by different scientists along with groundtruth with the samples.

Besairie 1972 in French	Translation to English
<p><i>Coupe Mandabe.</i> — A l'ouest de Mandabe et au sud de la rivière Maharivo, une coupe générale sur X 570 présente :</p> <ol style="list-style-type: none"> 1. — Callovien moyen et supérieur. Argiles à gypse, nodules calcaires, banc de grès au sommet (20 mètres). 2. — Oxfordien. Calcaire gréseux et marno-gréseux à oolites ferrugineuses (20 mètres). 3. — Argovien basal. Argiles gris jaune et gypse et Belemnites (20 mètres). 4. — Grès grossiers rouges argoviens mal stratifiés ou entrecroisés (110 mètres). 5. — Kimmeridgien. Grès fins à la base, Lamellibranches puis grès grossiers et, au sommet, alternance de grès calcaires ou marneux, de lits d'argiles et de lumachelles à Lamellibranche (120 mètres). 6. — Discordance, base de l'Albien. <p><i>Coupe nord Mangoky.</i> — Une coupe générale du Jurassique supérieur aux environs nord du Mangoky montre :</p>	<p>1.) West of Mandabe and at Mandabe Cut. south of the Maharivo river, a general section on X 570 shows:</p> <ol style="list-style-type: none"> 1. - Middle and upper Callovian. Gypsum clays, limestone nodules, sandstone bank at the top (20 meters). BASE 2. Oxfordian. Sandstone and sandy limestone with ferruginous oolites (20 meters). 3. Basal Argovian. Yellow gray clays and gypsum and Belemnites (20 meters). 4. Coarse red sandstones from Argovian, poorly stratified or cross-bedded (110 meters). 5. - Kimmeridgien. Fine sandstone at the base, Lamellibranches then coarse sandstone and, at the top, alternating of limestone or marly sandstone, clay beds and lumachelles at Lamellibranche (120 meters). [base = fine ss, mid = coarse ss, top = interbedded LS, marly ss, clay with fossils] 6. Discrepancy (=unconformity), base of the Albanian. <p>2.) North Mangoky Cut. - A general section from the Upper Jurassic to the northern surroundings of Mangoky shows:</p>

1. — Callovien inférieur, inséparable de la série du Mandabe supérieur. Grès blancs fins, argileux ou feldspathiques avec quelques bancs de calcaires à Corbules.

2. — Grès grossiers ferrugineux (15 mètres).

3. — Argiles grises à gypse et nodules calcaires (30 mètres). Début du Callovien moyen.

4. — Grès blancs légèrement calcaires (10 mètres)

5. — Argiles grises à gypse (5 mètres).

6. — Grès à ciment calcaire, Belemnites, Lamellibranches (13 mètres).

7. — Grès calcaires et argiles grises, bancs calcaires. *Peltoceras* de l'Oxfordien (25 mètres) surmontés de 15 mètres de calcaire jaune quartzeux.

8. — Grès ferrugineux rouges grossiers marquant le début de l'Argovien puis épaisse série de grès grossiers ferrugineux rouges avec dans la partie médiane des bancs de grès et lentilles calcaires à *Liogryphea dilatata* (180 mètres).

9. — Début du Kimmeridgien. Alternance de grès calcaires, de grès ferrugineux, de calcaires gréseux, rares argiles. Bancs à Lamellibranches et Brachiopodes (150 mètres).

10. — Calcaires kimmeridgiens à nombreux niveaux fossilifères, Lamellibranches et Brachiopodes (250 mètres).

C'est dans cette région du nord du Mangoky que la bande kimmeridgienne du bassin de Morondava atteint sa plus forte épaisseur qui dépasse 400 mètres.

1. - Lower Callovian, inseparable from the upper Mandabe series. Fine white sandstones, clayey or feldspathic with some corbulid (=clams) limestone beds. BASE

2. Coarse ferruginous sandstone (15 meters).

3. Gray gypsum clays and limestone nodules (30 meters). Early Middle Callovian.

4. - Slightly calcareous white sandstone (10 meters).

5. - Gray gypsum clay (5 meters).

6. Limestone cemented sandstone, Belemnites, Lamellibranches (13 meters).

7. - Calcareous sandstones and gray clays, limestone beds. Oxfordian *peltoceras* (25 meters) topped by 15 meters of yellow quartz limestone.

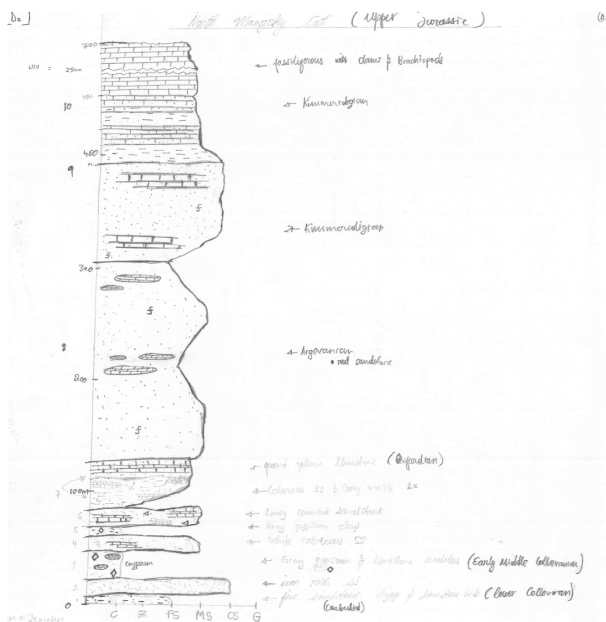
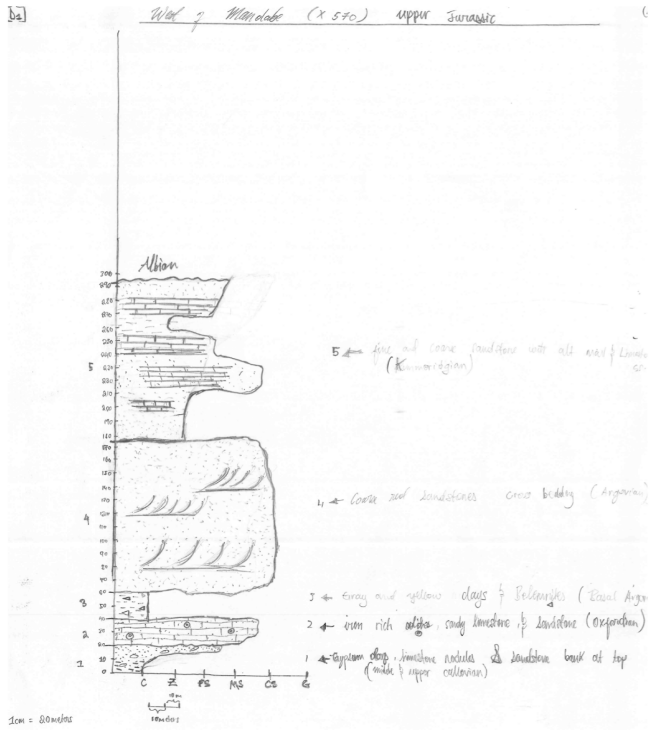
8. - Coarse red ferruginous sandstones marking the beginning of the Argovian then a thick series of coarse red ferruginous sandstones in the middle part. sandstone beds and limestone lenses with *Gryphaea dilatata* (oyster) (180 meters).

9. Beginning of the Kimmeridgian. Alternating limy sandstone, ferruginous sandstone, limy sandstone, rare clays. Lamellibranch and Brachiopod benches (150 meters).

10. Numerous kimmeridgian limestone fossiliferous levels, Lamellibranches and Brachiopods (250 meters).

It is in this region of the north of Mangoky that the Kimmeridgian strip of the Morondava basin reaches its greatest thickness, exceeding 400 meters.

Sections Constructed Accordingly



Conclusion

This research has allowed me to not only expand my french, but it also aided in discovering myself. I enjoyed every moment of it and it was clear that the more I got invested with the research the more I gained a deeper, better understanding of the french and also I became more precise with my work. It may have taken longer, however, it meant I was being accurate with my work.

On a much bigger picture, this is very important work because there hasn't been more research done on the Morondava basin when it encompassed oil-rich fields and these are fields with extremely low sulfur oils. Low sulfur oils are the oils that will help cut on the emission from vehicles. The cut back from the low sulfur oils from the Morondava basin will be good for the environment along with a cut back in cardiovascular diseases. There has to be more research done on the large Tsimiroro which is an onshore heavy oil field in central Morondava Basin and the giant Bemolanga extreme heavy oil field in northern Morondava basin with the world's largest and lowest sulfur (0.3%). Madagascar is not a very wealthy country and it could become one of the big OPEC countries which will help the country's economy. Madagascar has also just faced one of the deadliest droughts and hunger all due to climate change. They are paying a price for the effects of climate change when the biggest contributors to climate change are the more advanced countries. Utilizing natural resources to help advance the country will be very important for the health of the people. This is very important work that I will keep working on for my senior thesis and also I plan to present it at the Elkin Isaac.

This whole research had a big impact on my life however the part that had the biggest impact on my life was the trip to southern Idaho. I was able to learn so much about how to efficiently gather data that I am currently working with for the rest of the project. It gave me a great opportunity to see geology from a different perspective of a geochemist. It gave me the inspiration that I haven't felt before even though I have been around great and intelligent people. This inspiration was different and gave me a clear picture of the things I have to do to become a great geologist. Also seeing how efficient and determined Dr. Madeline Marshall was something I admired and it's exactly how I want to be invested in my research project and a future project that I take on. I learned so much and I was able to improve my field note-taking skills. I also learned how to make connections about things I had learned in the classroom with fossils and facies evident. Doesn't translate over as easily, but once things become more and more clear. I was given very valuable advice about the different paths for after undergraduates study also and gives me hope for the future. It has inspired me for my senior year at Albion and beyond.

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