CONCLUSIONS AND FUTURE RESEARCH SUGGESTIONS

CHAPTER 7

Conclusion

In conclusion it can be said that the application of Raman spectroscopy to archaeological problems in South Africa has been extremely successful and had quite a few positive outcomes.

- The results of the research projects have contributed to a better insight into the pre-colonial history of sub-Saharan Africa, a better understanding of the technology used by San artists and highlighted the unique attributes of one of our animal species.

- Since the first poster about the work was presented at an international conference held in South Africa in 2001, it has motivated other South African scientists to also apply Raman spectroscopy to studies on our cultural and natural heritage.[1-7] \

- The collaborative and multidisciplinary nature of the projects has created an awareness of the versatility of Raman spectroscopy as analytical technique.

- My work on the celadon shards led to collaboration with Dr. Philippe Colomban.

- On the international scene the work has been presented at four international conferences, I have visited the research laboratory of Dr. Colomban in France three times, where most of the experimental work for chapter 4 was done. It has placed me in personal contact with scientists doing similar rock art studies in France, Spain, Australia and America, which in the future might lead to further collaborative work. Dr. Colomban visited South Africa twice and gave a public lecture, hosted by the Spectroscopy Society of South Africa at the Sci-Enza Centre, which was well attended by people from Chemistry, Physics and Geology departments of various universities as well as from industry and the CSIR. He visited the Raman and Infrared facility in the Chemistry department and had a meeting with Prof. Ignacy Cukrowski (then Head of the Chemistry department) and gave advice about Raman instrumentation. Discussions with other staff members and their students led to the opportunity for a PhD student in the Chemistry department (Werner Barnard) to visit Dr Colomban's lab in Paris in August 2008.

- My work and visits to France has motivated a young French student (Aurèlie Tournie) to apply for a Postdoc position in the Physics department in 2009.

Future research suggestions

All four of the studies have opened new directions of research to be explored in the future, some of which are already underway.

- Chinese porcelain and Persian pottery shards have been excavated at inland archaeological sites in southern Africa, such as Great Zimbabwe, as well as sites all along the eastern coast along the ancient trade routes. Early in the 20th century, when the shards were originally classified it served as a rough dating method. In recent years, since China has opened its doors to the west, scholars such as Nigel Wood, had the opportunity to study the Chinese pottery and porcelain first hand in China, which has made it possible to detect provenance and production date more accurately. Similar in-depth research studies as performed on the Mapungubwe celadon shards would serve well to refine the interesting history of the African east coast.

- The study of the glass trade beads known as the Mapungubwe Oblates has shown that the production technology was very specific, but that the provenance of the beads is still a mystery. Clarification of their origin will help to lift the obscurity still surrounding Mapungubwe and its history. In order to do this I have started by analysing the other glass beads found at Mapungubwe and plan to expand the study to the large amount of beads that represent the African bead tradition in southern Africa.

- The research on rock hyraces and the follow-up work on hyraceam, which supports its use as treatment for epilepsy, should be continued to endeavour to find the active ingredient.

- The application of Raman spectroscopy to San rock art has been very successful and has resulted in a larger study, which entails analysing San rock art non-destructively with the use of a portable Raman instrument (from the lab of Dr Colomban) on exhibits in the Rock Art Research Institute (RARI), University of the Witwatersrand, as well as *on-site* in the Ukhahlamba Drakensberg Park and other sites around the country. The project is

undertaken in collaboration with the director of RARI, Dr Ben W Smith, who under the GDRI/STAR (CNRS) project facilitates collaboration on rock art projects in South Africa, Prof. Ian Meiklejohn (Geoinformatics and Meteorology of the University of Pretoria) and Dr. Sven Ouzman (Department of Archaeology, University of Pretoria). The results of our work will complement research studies on rock weathering and conservation.

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