# The conservation of Lapita pottery, ignore it at your peril

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## Introduction

The local Department of Archaeology of New Caledonia has been studying excavation site WK0013 since 1992 (Sand and Ouetcho 1992; Sand 1995; Sand, Ouetcho and Bole 1996). The different sites of Lapita are located on the west coast of Grande Terre, near Koné. Most of these sites have disappeared in part due to sea erosion, especially over the last 100 years. In October 1995, an unexpected extension of the construction of a commercial shrimp pool at the border of the only well preserved Lapita site, listed as WK0013A, destroyed part of the insitu layers. Every effort was made to save as much of the pottery and other material as possible (Sand 1996).

As always when in Lapita territory the eroding beach front was surveyed. This led to the discovery of the upper part of a Lapita pot, surrounded by other large pieces of pottery at the base of an eroding small cliff. It appeared that part of the encrusted pot filling had eroded, as some big pieces of Lapita pots were discovered further down the beach and the upper part of one entire pot had been washed away. It was realised at the beginning of the excavation that there were only three working days before a high tide was due that would completely cover the pots. Thus the area had to be excavated in a very short time. It was not possible to conduct a thorough, fully recorded excavation within the time and staff limits.

The first task of the excavation was to clearly define the extent of the Lapita area. This led to the discovery of a second set of pots under the cliff. At first it was thought that these were only parts of pots but when the excavation began a second complete pot was found and it was felt that a great moment had arrived.

To summarise, the greatest amount of sherds was around the first complete pot discovered, called Pot 1. It appeared at the excavation that large pieces of broken Lapita ceramics were placed at the bottom of a pit dug in the sand and these were covered by a complete Lapita pot approximately 55 cm in diameter, which had a hole in the bottom. On this pot were found other large pieces of decorated and undecorated base Lapita pieces. In some areas, five levels of pot sherds were superimposed. Plaster bandages were used to assist in the lifting of large sherds where possible. The second pot, Pot 2, was better preserved as it was protected by the cliff. It was covered by some large sherds, especially a sherd illustrated with faces. Smaller Lapita sherds, some with unusual patterns, were also found under it.

An attempt was made to try to keep Pot 1 and its encrusted contents in one piece. It was wrapped with plaster bandages. This was a partial failure as the pot began to crack when carried to the car, followed by transport on the bad road to Koné and then the 250 km journey to Noumea.

As Pot 2 was clearly broken, time was short and no more plaster was available within 40 km around Koné, it was decided to remove the pot in pieces. Part of the filling attached to the inner parts of the sherds of Pot 2 was kept for residue analysis. The pit was dated by charcoal to 2820 +/- 50 BP (Beta 92752, AMS Oxford) calibrated 2970 (2860) 2770 BP: it was clearly made during the period of Lapita production in this site (Sand in press).

These pots were not the first to be found in the Lapita site WK0013. Two other large pieces were found during the previous years (Sand and Ouetcho 1993). Due to lack of money they had not been conserved and had collapsed. A sponsor was then found to pay for the conservation of the October 1995 find at the Australian Museum.

The Australian Museum's involvement with the October '95 find started with a call from Christophe Sand. His excitement was of course infectious but logic had to play a part. Some poignant questions were asked. Do you have a lab for solvent based materials? Do you have access to distilled or deionised water? Are you aware of the time needed for conservation work? and... are there sufficent funds? The answer to all questions was unfortunately, no. There was a great deal of frustration at not being able to jump on a plane and start the conservation process immediately.

The purpose of the conservation project was to stabilise all the pottery and to reconstruct as much of it as possible. This process of stabilisation included the removal of salt (desalination), the strengthening of the pot fabric (consolidation), plus the construction of internal support systems for the near complete pots as well as an adequate transport system for their return to the Northern Province of New Caledonia.

In January 1996, Anne Léculier, a French-speaking staff conservator, travelled to New Caledonia to pack the fragile Lapita sherds in a short period of time and with minimal resources. By this stage, four months had passed, in which time the pots and sherds had been stored in a tin shed with all the vagaries of climatic extremes.

# The conservation

The excavation procedures were less than ideal, as described above. One of the problems for the task of conservation was that the plaster had never set properly and was thus a poor substitute for a support framework. This served to highlight the need for practice and experience in lifting and storing Lapita material other than for small loose sherds.

Neither of the pots remained intact due to damage during excavation and lifting. What appeared initially during excavation to be a completely intact Pot 1, for example, was in fact a pot arriving in the laboratory with clear break lines (many fresh) that had been held in a compact mixture of plaster bandages, foam and cardboard packing stuffed with polystyrene-filled cotton bags. During excavation hardwood planks were pushed directly under the excavated pottery, heavily scoring the base sherds and stressing the rest of the pot.

It can be suggested for the future that where material of this nature is found, the pottery is reburied until planning has been undertaken. In the case of this site, reburying the pots and filling as many plastic garbage bags as possible with wet sand and piling them against the incoming tide could have been considered. The waves were not pounding and heavy bags would have certainly done a good protective job.

# Desalination and consolidation

The intention was to keep as much of the pottery in one piece as possible, and especially to maintain a profile from rim to base with Pot 1. With this in mind, many small cracks in the Pot 1 and the large sherds were faced with a Japanese paper and adhesive system before desalination could take place.

On arrival in the conservation lab of the Australian Museum, all sherd types were sampled and tested to determine salt levels, to assess durability for its removal and to select treatment options. All the pottery contained salt to varying levels.

When pottery that has been impregnated with salt-rich ground or sea water dries out, salt crystals form, exerting considerable pressure on the clay particles that make up the matrix of the pottery. With constant changes in relative humidity in the natural environment of the Pacific region, the wetting and drying process continues, with consequent dissolving and regrowth of salt crystals. This process eventually breaks down the fabric of the pottery. The rate of destruction depends on the inherent cohesiveness of the pottery and the extremes in relative humidity over time. It is important to understand that the pressure of crystal growth is huge (estimated to be between 1000-2000 atmospheres, (Stambolov 1976), and that is the reason why there can be total breakdown of the fabric of the pottery.

The purpose of the desalination was to achieve the removal of as much salt in the ceramic as possible. The monitoring process was graphed. An ideal graph is illustrated as Figure 1, with the final conductivity readings being at least below 150 umhos/cm. It was found that in general the higher the salt content, the more fragile the fabric of the pottery and thus treatment compromises had to be made. This entailed reduced soaking time for soft sherds and an acceptance of removing them at higher readings rather than longer soaking to reach the ideal conductivity values.

Baths were set up for the pottery. The water still was put into overdrive to produce enough distilled water (with a conductivity of 6.3 umhos/cm) that was needed to change the baths until the salt levels were considered safe for allowing the sherds to dry out. As there were hundreds of sherds, where the salt levels were excessively high, tap water was initially used (reading of 180 umhos/cm), with distilled water saved for the final baths.

As can be seen with the New Caledonian experience, salt levels varied in sherds even from the one site. This variation can depend on the depth of the find, the fabric of the material, the variation in water table, the wicking effect as the sherd dries, as well as the salt concentration of the ground water. Speedy removal of the salt can make or break the survival chances of the pottery.

It can be demonstrated with the New Caledonian find, the longer the material had been exposed to the air either at the top of the excavation or stored over time, the greater the deterioration. Where pottery was excavated wet and kept wet until it was placed into the desalinating water baths, the success rate for preservation was greater. This can be seen in the final product of Pot 2 where the top dried out during the excavation procedure causing cracking and deformation. The top will now always be weaker than the base, which had remained wet at all times until conservation.

Another problem encountered was the insoluble salts causing disfiguration of the surface, hiding decorative and other features of the pottery. The removal of this material involved the use of an acid solution to dissolve the calcium-based encrustation. Technique, practice, timing and washing away the acid residue were vital to this process if the sherds were to last. The complete removal of the acid solution was particularly important for some Lapita ware when the sherd contained a high percentage of calcareous material (such as shells) that was also prone to acid attack.

The pottery was removed from the baths and allowed to air dry with the aid of a fan for about 7 days on an open wire racking system at 21 C and 55 % RH. This left the pottery salt free but still very weak, to the extent that it crumbled when touched. It was necessary to consolidate all pieces.

The consolidant used was a 10 % solution of Paraloid B72 (a copolymer of ethyl acrylate methyl methacrylate, Rhom and Haas) in equal volume mix of acetone and toluene. Paraloid B72 was chosen as it is a standard conservation-quality consolidant and has been well documented for the conservation of archaeological ceramics. The dry desalinated pottery was saturated with the Paraloid solution using vacuum impreganation for up to one hour. After breaking the vacuum and removing the sherd pieces from the resin solution, the evaporation of the solvent was assisted by air movement in a fume cupboard for one week. Because the solvent mix was toxic and highly flammable, appropriate health and safety measures were observed.

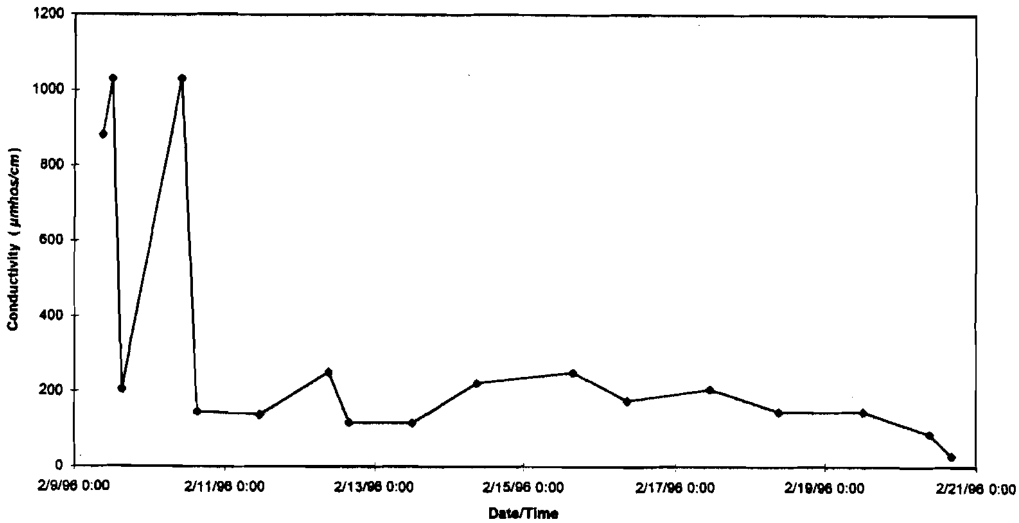


**Figure 1**
Desalination graph showing initial high salt levels in the ceramic measured via a conductivity meter. Each change of distilled water reduced the salt levels over time.

# Reconstruction

As the solvent vapour dissipated and the consolidant strengthened the sherds, the process of reconstruction was undertaken. This required a team effort. It was vital at this stage for the conservation team to work with Christophe Sand, the archaeologist. The pots had sprung and there was no opportunity to exactly reconstruct them without significant cracks and spaces. While appreciating the ideals of the archaeologist and having to cope with the practicalities of the physical stability of the pots, a compromise was reached whereby Pot 1, for example, was reconstructed to produce a stable object with logical profile.

To achieve the best possible result, the pots were in part reconstructed dry before agreement was reached as to the final shape. HMG Paraloid B72 adhesive was then used to tack the sherds together. Minimal adhesive was used to enable minor adjustment through ties and hand pressure during reconstruction.

Gap-filling of the pots was undertaken where there was significant sherd loss and the overall strength and stability of the pot was in joepardy (Fig. 2). Every attempt was made to leave stable sections unfilled that would then give access to sherd profiles. A related colour was achieved, but there was no attempt to reproduce the incised designs (Fig.3).

As the pots would always be fragile, polyurethane foam support systems were constructed around the bases. These would be used for storage and transport. A separate aluminium internal framework was prepared for display purposes.

It is interesting to note that the reconstruction of Pot 2 progressed more rapidly. The original fabric of the pot was much more stable, as it appeared to have been fired at a higher temperature. We are waiting for the Thermoluminescence (TL) results. The reconstruction also progressed rapidly due to the fact that when the archaeologists excavated the pot they numbered each sherd. When it came to reconstruction, the basic correlation was there.

One of the most unusual features of the Pot 2 reconstruction may have significance for the future assessment of sherd finds. There was a clear distinction between the fabric of the body/shoulder section and the neck/rim section. The neck/rim section was a rich red matrix throughout whilst the body/shoulder section was made from an apparent layer build up, with clear layer lines defined through red, brown and black colours and textures. Had the two sections been found separately there would have been no clear indication that they were in fact parts of the same pot.

Salt was not the only killer. The inherently fragile nature of some of the pottery (sometimes combined with high salt content) led to its virtual disintegration unless it was consolidated. This was generally due to the low-fired nature of the pottery but could also be due to the low clay to filler ratio such as shells and fine pebbles (Fig. 4). The conservation treatment followed for these poor quality sherds was consolidation without desalination. This at least enabled them to be photographed, handled and drawn before they in time eventually deteriorate. For the moment the lab is in the experimental stage for this treatment process and it is expected that by using a variety of conservation quality materials, the pottery will last at least for a few years.

Further experimentations are underway for the treatment of very poor quality pottery. The first concept is consolidation to be followed by desalination. The second concept is firm packing in poultice washing systems followed by consolidation. Both systems take a great deal of time and will form the subject of another paper.

One may wrongly assume that the salt problem may not exist if a site is not directly beside the sea. It should be kept in mind that the term salt does not only relate to the sodium salts such as sodium chloride (NaCl), which undoubtedly is the most harmful. Most water soluble ground salts come in many different compositions such as sodium, potassium, magnesium and calcium salts of chloride, carbonate, sulfate and phosphate ions. These all can be harmful over a long period of time if the ceramic is allowed to dry out before salt removal.

Figure 2
Fragments of pottery efter reconstruction in relatively good condition.

Figure 3
Illustrating the use of a gap filler for structural strength without replicating the design.

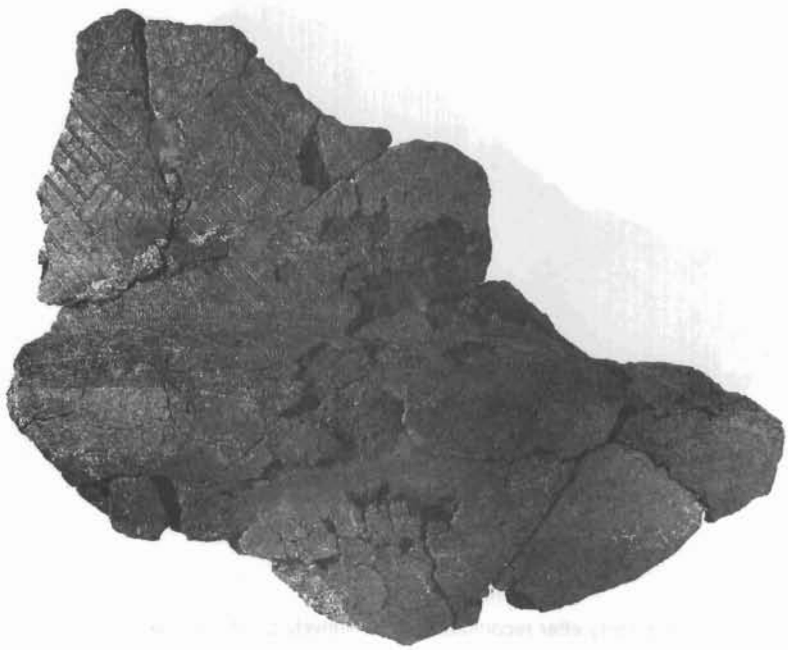

Figure 4
Fragments of pottery after reconstruction showing excessive loss due ot low firing combined with burial conditions.

# Recommendations

Where preservation is an issue, the following is a set of recomendations.

1. Plan to employ conservators on site during all or part of an excavation. Conservators are not unusual in the fact that many have worked on archaeological sites for years before moving to study archaeological conservation. The consequences of the collaboration between archaeologist and conservator in this instance have been a better understanding of what conservation can achieve and what it could have achieved at lesser expense, had conservators been more involved from an earlier stage. The conservators on the other hand have developed a better understanding of the final product and the analytical needs of the New Caledonian team. It can be noted that for the first time, two conservators worked on the September 1996 Lapita excavation directed by Dr Sand. During that time about 6,000 sherds were desalinated to safe tap water level, a skeleton was lifted and site archaeologists were introduced to the basic conservation skills that they can now adopt.

2. Become familiar with some of the basic conservation skills whilst at the same time understanding the limitations. Various forms of lifting, for example, are well documented (Payton 1993) and the Division of Materials Conservation of the Australian Museum is available to give workshops on the subject.

3. Assess the probability of deterioration and understand the short and long term storage environments of the excavated finds. The excavated pottery may look and feel in sound condition. Experience however shows that the conditions of storage which can be considered normal for the Pacific, lead to significant deterioration of material. When, for example ceramic material was excavated in 1991 in New Caledonia, it was described by Christophe Sand as exhibiting excellent decorative features. By 1996 this material had lost all features.

4. Send samples of pottery varieties and associated finds to a conservator experienced in conserving low fired archaeological material. At that stage the pottery can be tested for salt content.

5. Know the limitations of available finances. It is accepted that excavations in the Pacific are undertaken on the proverbial smell of an oily rag. That oily rag is usually in the form of a grant as anywhere else in the world. One can only request on behalf of the material, its owners, and future students of Lapita, that funds are also found for the preservation of excavated material.

# Conclusions

The Australian Museum Materials Conservation Division is available to assist with the preservation of Lapita material. Although the site in New Caledonia may be geographically and topographically dissimilar to other sites in the Pacific, the conservation problems for Lapita material have been remarkably similar. The Division has conserved over 1500 pottery items from PNG and New Caledonia since 1983. It will continue to build up a data base for salt levels and appropriate treatment processes for Lapita pottery. With this information there will be a greater opportunity to more reliably predict the length of time the material will need for treatment.

There are examples in practically every university or museum in the world, of both organic and inorganic archaeological material that is stored in boxes barely touched since it was excavated, virtually unrecorded and deteriorating through lack of conservation treatment and adequate preservation environments. The same can be said for the Pacific and specifically for Lapita material. There are instances where important material that has been published now does not exist due to inadequate handling and lack of appropriate preservation procedures. This is true despite the fact that there are agreements with originating countries for the eventual return of this material.

It is vital that the conservation of Lapita material is undertaken where necessary. The material will then be accessible to future generations in the Pacific countries, students of Lapita and the general public.

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