Investigation of Methodologies for Fiberglass Resin Removal from Bone

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Introduction

A human skeleton that had formerly been used as a theatrical stage prop was improperly conserved using fiberglass resin, making it unsuitable for teaching collections (Fig.1). This project evaluates the use of solvents and heat for removing fiberglass from bone, in an attempt to return this skeleton to a more useful, and ethically responsible, condition.

In the initial stage of research, different removal methods were tested on pig bone as a proxy for human material (See Table 1). In the second stage, a small scale test was performed on the human remains. Finally, the entire skeleton was cleaned.

Table 1: Fiberglass resin removal techniques

Removal method	Agent	Application of agent	Bone sample
Chemical	Acetone	Soaking and surface brushing	Green long bones, dry vertebrae and ribs
	Ethyl acetate	Soaking and surface brushing	Green long bones, dry vertebrae and ribs
	Dichloromethane (DCM)	Soaking and surface brushing	Green long bones, dry vertebrae and ribs
		Soaking	Human skeletal remains
Heat	Heat gun	Surface application	Green epiphysis and dry vertebrae

Figure 1: Fiberglass coated human skeletal remains

Methods

The bones used for the first stage of testing consisted of green (fresh) and dry pig bones to ensure that the most appropriate method could later be applied to the human remains. A combination of long bones, vertebrae, and ribs were coated in fiberglass resin and allowed to cure (See Figure 2). Two main methods of fiberglass removal were then tested: chemical solvents and application of heat.

Solvent removal: was attempted, first, through small-scale brushing applications and second through total submersion of the bones (Figure 3; Table 1).

Heat testing: was performed with a heat gun and scalpel to remove the loosened resin; a digital thermometer was used to monitor the heat ranges.

After determining the most effective technique on pig bones (DCM submersion – see *Results*), the second stage was to test this technique on the right arm of the human skeleton. Finally, the entire human skeleton was cleaned.

Figure 2:Using bones from a butcher and the MacEwan zooarchaeology collection, Bondo© fiberglass resin was painted onto the bones and allowed to cure after two coats.

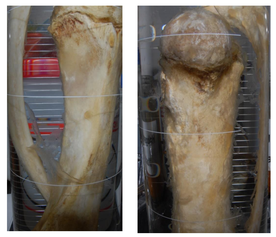


Figure 3: Ethyl Acetate (left) and Acetone (right) removal in process. The solvents reacted differently with the resin. This resulted in peeling with the ethyl acetate and flaking with the acetone.

Results: Resin Removal from Pig Bones

Acetone
The acetone soak worked well, and with a little manual manipulation, the resistant resin was easy to remove. However, both the green and dry bone developed a greasy feel.

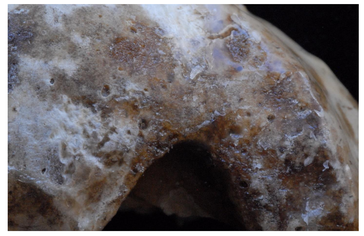
Figure 4: Acetone Removal

Ethyl Acetate
The Ethyl Acetate worked to an extent. After soaking, large areas remained covered in resin, some of which came off with assistance. However, the bones developed a greasy feel.

Figure 5: Ethyl Acetate Removal

Dichloromethane (DCM)
DCM gave the best results for resin removal. The bones were cleaned in the least amount of time with minimal manual manipulation required. Also, the bones dried quickly and did not develop a greasy feel.

Figure 6: Dichloromethane Removal



Heat Gun
Both the green and dry bone were able to be manually cleaned with a scalpel at around 60ºC. However, heating to 100ºC resulted in the resin impregnating the bone and becoming very difficult to remove.

Figure 7: Heat Removal

Results: Resin Removal from Human Bone (DCM submersion)

Initial Condition
The fiberglass coating on the human remains left the joints rigid and the bones unsuitable for analysis. The bones were also held together by a wire frame.

Figure 8: Example of the fiberglass coating

Final Cleaning Stages
Following resin removal, it was discovered that many bones had also been painted. So, the remains were cleaned with acetone to remove the paint and additional adhesive residue.

Figure 9: Skull half cleaned of paint

Completion
After removal from the metal frame, the remains are now fully disarticulated and ready for inclusion in anthropology teaching collections.

Figure 10: Completed cleaning

Discussion

Conservation of skeletal material is guided by a number of key components: stability of the material; durability of the consolidant (material used to conserve the artefact); ability to remove the consolidant should this be required; and no alteration of the skeletal remains that would limit future analysis (Cronyn, 2003, López-Polin et. al, 2008). The use of fiberglass resin meets the first two criteria but with no published literature found on the removal of fiberglass resin it was unknown whether or not the latter standards were met. As such fiberglass resin is not an appropriate conservation method and research was required into methods of resin removal and the impact of fiberglass resin on bone. This research has provided a successful method to remove fiberglass from bone that will allow for improperly conserved material to be incorporated into collections. This will allow for the remains to be used in an ethical manner that upholds the moral obligations to conserve the university's collections (Applebaum, 2007). The fiberglass coated human skeleton housed at MacEwan University is currently being treated and will be included in anthropology teaching collections in the near future.

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