

HISTORICAL LEATHER FOR BEGINNERS

INTRODUCTION

Ever since modern Roman re-enactment started, leather armour has been “an issue”. Back in the 1970’s the founder of modern Roman military equipment studies, Russell Robinson, argued against its use, and others have followed in his footsteps. But recently there have been several books and theories advocating such armour.

Unfortunately writers and archaeologists are seldom specific about the type of leather they mean. Leather is not just “leather”, but an animal product produced by a variety of processes, and often more than one.

This short introduction examines the types of leather available to 4th century Roman re-enactors, and gently examines the leather available for armour construction.

LEATHER TYPES

Alum-tanned leather is mineral tanned or tawed. Alum is mixed with salts and a variety of binders and protein sources, such as flour and egg yolk. Alum-tanned leather is technically “tawed” and not tanned, as the resulting material will rot in water. Very light shades of leather are possible using this process. The Hellenistic and Roman periods alum tawing would have been about the only form of mineral tannage available. Due to its poor resistance to water when not combined with other tannages such as oil, this leather would probably have been used more for indoors applications in temperate climates. Alum tawed leather is a poor choice for military applications (except perhaps in very dry climates) as the alum tends to be poorly fixed and is easily washed out if the leather becomes wet. Oiling the leather could help stop this. The Romans called tawed leather *aluta*. It seems to have been used occasionally for sails in later periods. And I read on the internet that the Greeks used it for shoe uppers, probably made from tawed goatskin. However no reference is given. An interesting discussion about tawed leather production and conservation is available at http://cool.conservation-us.org/iada/ta99_067.pdf

Vegetable-tanned leather is tanned using tannin and other ingredients found in vegetable matter, tree bark, and other such sources. It is supple and brown in colour, with the exact shade depending on the mix of chemicals and the colour of the skin. It is more common through history than tawed leather. It can be coloured by dyeing, painting and waxing. Alum can be used to whiten the leather. It is the only form of leather suitable for use in leather carving or stamping, and therefore the only form of leather possibly used in decorating certain panels on tube and yoke armours. It can be soaked and then dried in a mould generally made of wood to make hardened leather armour. When waterproofed using molten wax we would call this *cuir bouilli*. Such leather could be laminated using its natural gelatines, or by various dairy based glues. A single hide could be a maximum of around 5.5mm thick. But you could laminate three 3mm thickness’ of hardened leather to get 9mm thick hardened piece of laminated leather. Such a process would produce a stiff armour, perhaps resulting in an upstanding yoke if used to make a Hellenistic tube and yoke cuirass. And the way we sometimes see the tube wrapped around the body more than once mirrors the laminating process. However the edges of laminated leather would be susceptible to damp, and would need edging. In my opinion this edging can be seen on tube and yoke armours.



Wrapping the cuirass around the body from a Greek 5th centuryBC pot.

Turning to history, from the Roman period we have hardened leather lamellar from Dura. This is basically leather, perhaps wetted, and then hardened by heat. Possibly from a non-Roman tradition, they were worn like riding chaps although some believe them to be crinets for a horse.



The Dura thigh guards showing one lacing method.

They consist of overlapping scales attached to each other by leather lacing, each thigh-guard using its own distinct lacing method. They defend against horizontal blows and strikes from above, presumably from enemy cavalymen and arrows. The armour is in fact a form of lamellar, but the method of construction is similar to scale. The lacing method and materials used result in a flexible armour, fitting over the knee and protecting from the waist to the shin. Each scale would have been treated using heated wax or oil, toughening it and shrinking it at the same time. Such armour is light to wear and easy to repair. This technology lasts through to the medieval period. J W Waterer (*Leather and the Warrior*, Museum of Leathercraft, 1981) looks at European leather technology. He suggests that untanned rawhide was seldom used for protection in the

medieval period. Instead he sites various examples of tanned leather, soaked (samming) and then rapidly dried in a mould.



Leather lamellar, 9th century Khaza. Some of the lames are laminated.

From China, a technological innovator, we have hardened leather lamellar, lacquered leather,

moulded leather armour, plus shaped and hardened leather plates. We see such technology from before the Han Chinese through to Tibetan armours made relatively recently. Arabic armours mirror the use of hardened leather, perhaps laminating it using its natural gelatines as in India. This is my favoured option for the tube and yoke cuirass seen on Roman and Greek artwork. Early 12th century European recipes describe the use of cheese and warm water to make casein glue. Arabs would steep the leather in milk to make laminated armour or leather shields.

The only possible reference to alum tawed leather I can think is the lamt shield of the Berbers. This almost mythical shield seems to have been made using laminated hide tanned with milk and eggs. The milk and eggs reference seems close to the proteins that need to be added to the tawed leather to make it supple. But it could be more dairy-based glue. David Nicolle (*Companion to Medieval Arms and Armour*, Boydell Press, 2002) does suggest that this type of shield, was made using untanned leather (rawhide?) in Somalia until modern times. Nicolle also gives two 12th century Fatimid recipes for making armour, one using laminated camel skins glued using milk and soda, the second possibly using shavings of rawhide mixed with other ingredients and moulded.

Rawhide is a hide or skin that has not been tanned, and is generally lighter in colour than leather which has been vegetable tanned. The fur, meat and fat are removed and the rawhide dried over a frame. It goes hard and almost translucent. It can be wetted, moulded, and dried to the desired shape. It can be left hard or “worked” by stretching, bending and by chewing. Like all leather it can be oiled or treated with fat to provide a degree of waterproofing. In Japan armourers used lacquered rawhide lames to build light armours. Several layers of lacquer were used to waterproof and colour the rawhide. Such armour used deerskin or silk lacing, which soaked up water and collected mud making armours heavy and cumbersome. Eventually they resorted to vegetable tanned leather to try and cover the armour, making it inflexible and heavier to wear.



I have some experience of using rawhide. My coracle was made using a form of rawhide, and it was used to cover saddletrees because of its resistance to abrasion. However after the American Civil War the rawhide on McCellan saddles was covered in vegetable tanned leather to improve its resistance to water. In history both tawed leather and rawhide were seen as susceptible to dampness, including sweat. Sweat would leach the alum out of tawed leather, and make rawhide soft.

Buff leather is a term UK re-enactors love, due to its connotations with 17th century buff coats of the English Civil Wars. We use it too readily. I recommend Professor Procter, *Principals of Leather Manufacture*, 1922.

We can simply define buff leather as **oil tanned leather**, producing a buff coloured leather. The wet skin is oiled or greased, stretched and kneaded until moisture is lost and fat is absorbed. This is a very old process dating back to the first leather preparations. The brain tanning of the USA is linked to this, where brains and smoke were used the same way. Graham Sumner in "Roman Military Dress" gives us the accepted view that there is no Roman evidence for oil tanning, yet it is perhaps the oldest method of leather preparation. In 17th century Europe marine oils were used, and some of the first machines used in tanning were made to help pummel the oil into the hide. The hides were first soaked, often using lime, dried using sawdust and oatmeal, then oiled. Lime helps the quality of the oiled leather. The ancients may have used wood ash. The shales of North Yorkshire produced alum by large-scale chemical processing from the early 17th century. This is the origin of the white buff leather military belts. The wood ash, alum and lime opened up the fibres of the leather making it easier to oil. Back in classical times I suspect small skins could be oiled successfully without the use of alum or lime. But not large thick skins. There is a reference in Homer's Iliad where he compares the struggles between Greece and Troy to that of a man trying to stretch a huge cowhide soaked in lard. Evidence of liming dating back to Anglo Saxon times suggests that medieval tanners were using liming to remove hair and open up the fibre structure and would have used this in their manufacture of oil tan buff leather.

Military buff leather can be seen as thick leather, usually between 3 to 5mm, which requires a heavy cattle hide. First of all the hide is washed and then treated with a liming solution which burns off the hair and swells up the hide. This allows the hide to more readily soak up the oils. By the 18th century a band knife splitting machine was used to split the hide in uniform thickness. Then the strongly alkaline lime residue was removed from the hide using acid salts. Before the oiling a samming machine like a mangle removed excess moisture. Then cod oil was used for the tanning, and beef tallow as a lubricant.

CONCLUSIONS

So for leather armour we can chose from vegetable tanned leather, tawed or mineral "tanned" leather, rawhide and oil tanned buff leather using alum or lime in the tanning process. There seems much evidence for the use of vegetable tanned leather, little for tawed leather and rawhide, and processing issues around oiled leather.

The reference from Homer suggests that thick hide could not be oil tanned easily in antiquity. Thin hides could be oil tanned and would make other types of military equipment. Buff armours made using lime could be used at least from the Anglo Saxon period. Buff armours made using alum could be made industrially from the 17th century.

Having considering several thousand years of history, my limited knowledge comes up with many and varied references to hardened vegetable tanned leather, sometimes laminated. It can be decorated and stamped. I'm aware of one questionable reference to shavings of rawhide being

used to make moulded armour, and one relatively modern African shield perhaps with a long tradition, using possibly laminated rawhide. There is a mythical possible use of tawed leather to make a shield. There is the famous crocodile costume, called armour by some. And Nearchos via Arrian mentions Indians carrying light shields of raw oxhide, perhaps another form of leather armour. The Samurai used rawhide, heavily lacquered, as a light armour preferred by the elderly. I hope others may be tempted to add to this summary.



Macedonian/Roman Republican cavalryman in leather tube and yoke armour.

So “in my opinion” hardened vegetable tanned leather, possibly laminated and whitened using alum to match written evidence and iconography, is well attested. Especially in the Hellenistic period. Such armour could be burnt when worn out as described during Alexander’s Indian campaign, and painted or perhaps dyed to colour the armour. Coloured wax was used on leather from Dura to make it red. Hot coloured wax could harden and colour leather armour at the same time and this process was used on my Dura-style thigh guards, coloured black.

Cowhide would be an obvious choice, but laminated goat and deer hide could be used. Pig and sheepskin would be too thin. However please remember that little Roman leather armour has ever been found. We are limited to the Dura find and various possible/improbably leather fragments. Many other types of leather equipment have being found, and the lack of leather armour suggests it was not common. Compared to copper alloy and especially iron, leather would make an unsatisfactory armour, fit for parades or as a backing for metallic protection.

Throughout the Roman period, and in our period especially on the arch of Arcadius, musculata is depicted, some of which seems flexible and therefore unlikely to be made of metal. In the Yorkshire Museum the statue of Mars has a musculata with integral sleeves which if made of metal would mean the God could not move his arms. Many have used such iconographic evidence as proof that leather armour existed. This could be written off as artistic licence looking back to a classical artistic style long dead in reality. Or we could be looking at some sort of protection to be worn under metal armour, which is my view. Composite armour offers better protection than metal a lone, and metal armour needs to be worn with some sort of backing or padding made of organic material. Moulded vegetable tanned leather could provide a backing to metal armour, or be worn by itself in times of shortage or as a limited armour. However such an explanation begs the question, why has nothing like this been found when so much leather survives? And would it not be easier to just make a padded garment, perhaps covered in leather for water proofing?

Speculating about Roman leather armour can be enjoyable, but in Comitatus we need to deal with just more than iconographic guesswork. A contemporary written description would be helpful, and a few archaeological finds would move the debate on considerably. In the meantime let us appreciate the Dura find and avoid too much interpretative guesswork.

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