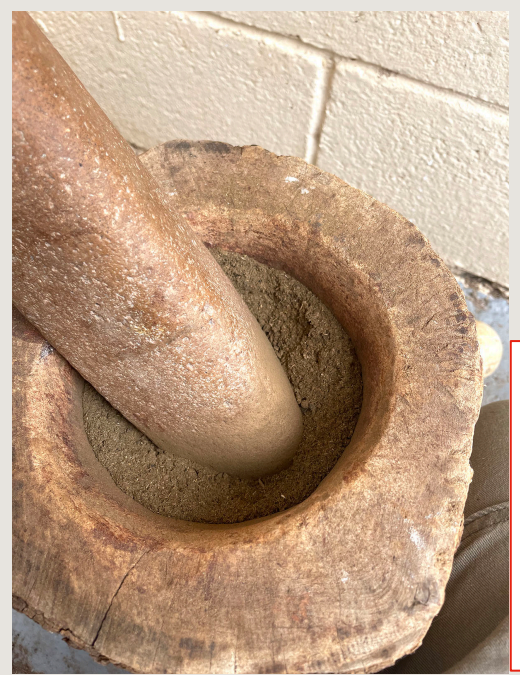




Question

What are the properties of insect lac and pine pitch and how do they compare? The use of adhesives for hafting tools and other purposes was used worldwide. Pine pitch was considered the primary adhesive used until a recent analysis showed insect lac to have been used by Hohokam, Mogollon, and Ancestral Puebloan people (Pool, Bisulca, 2016). Comparing the properties of pine pitch and insect lac shows how these adhesives could have been favored for different applications. Two tests were done to compare the two adhesive's properties focusing on weathering effects and hafting strength.

Method for Making Pine Pitch



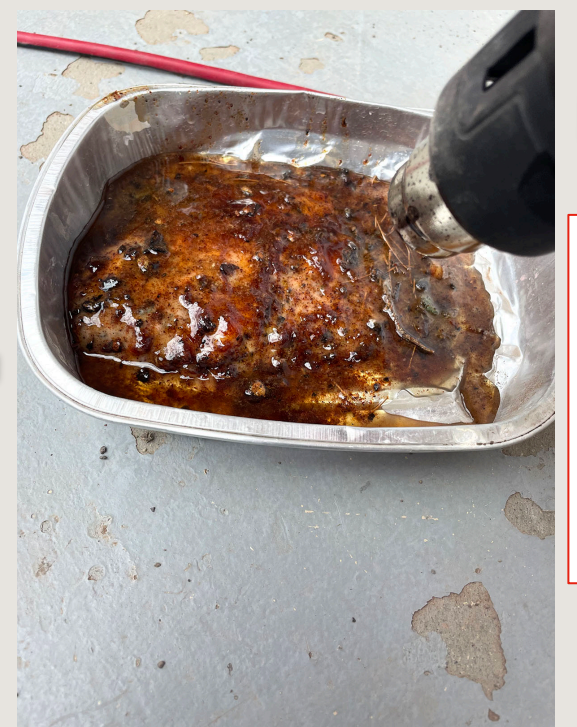
Deer droppings collected around camp were ground with a mortar and pestle



Pine resin collected from a sick tree at the start of the heating process.



Ground deer droppings and other additives like red ochre in this version are mixed in while resin is hot.



Once pine resin was boiled to a viscous state large chunks of bark and debris was removed.



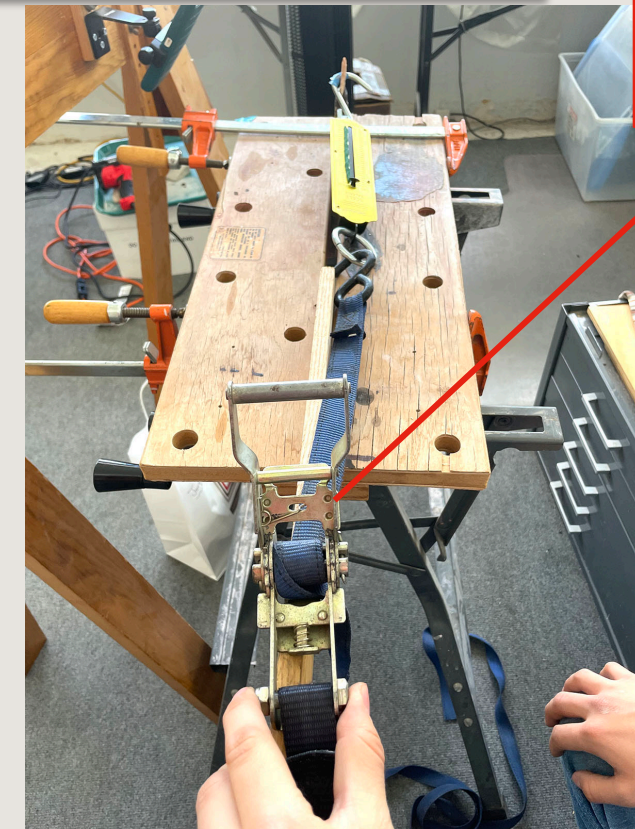
The pine pitch mixture is layered onto a stick making a "pitch stick" to store finished product for later use.

Strength Test Method

The strength test was done with a freshly hafted biface that was pulled off the haft along the notch using a ratcheting system to measure the pounds of force it took for the adhesive to fail.

Fish scale with clay stuck next to tab for marking the amount of weight to pull biface off foreshaft.

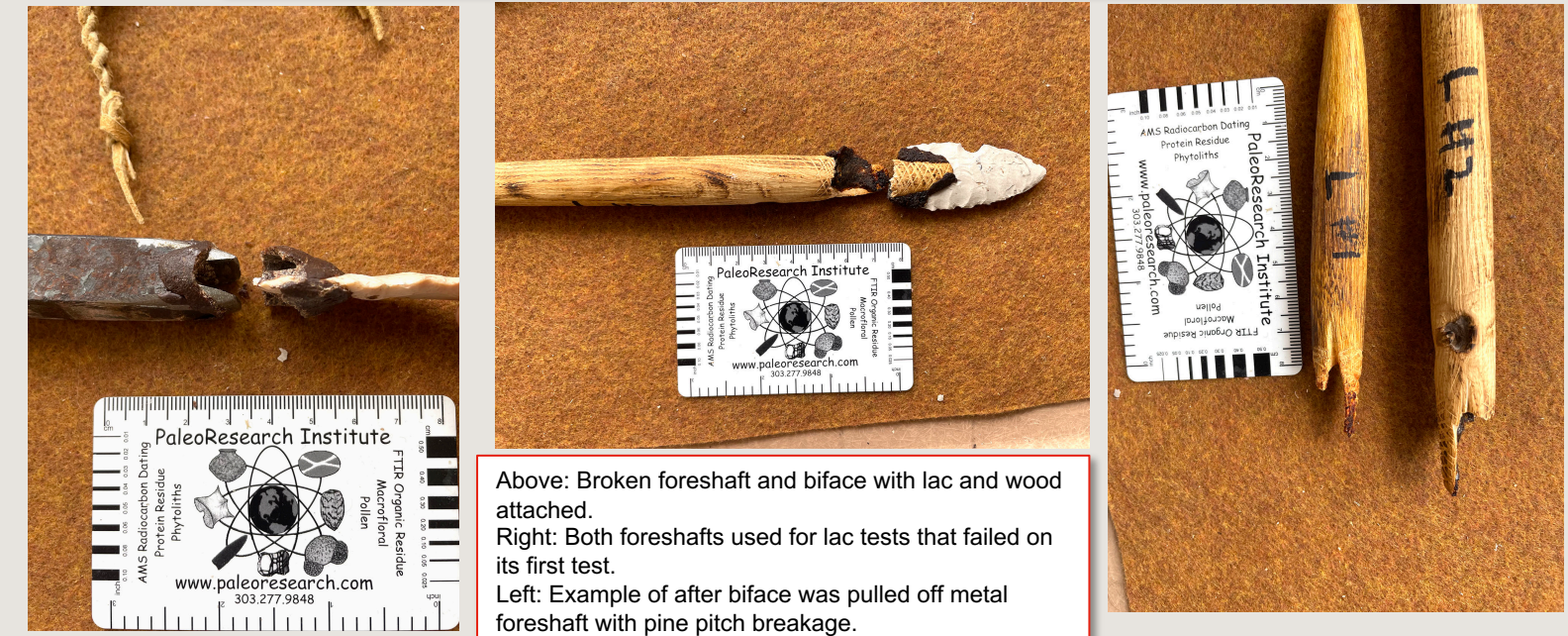
Biface hafted onto foreshaft clamped onto bench to keep it from moving.



Ratchet strap hooked to fish scale for controlled force when pulling on biface.

Problems Encountered

- ❖ Wood foreshafts were originally to be used but created a variable as it broke before the insect lac's strength would fail.
- ❖ A metal railroad spike was used in place of wood. The pine pitch could stick well but the insect lac had trouble gripping onto the metal and stuck more to the biface as shown by the two tests with lower weight.
- ❖ The method for testing strength was successful but needed refinement to keep the scale and hafts stable for proper weight readings.

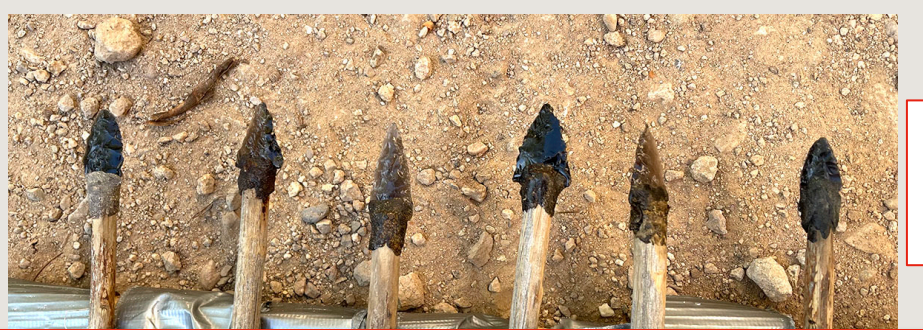


Above: Broken foreshaft and biface with lac and wood attached. Right: Both foreshafts used for lac tests that failed on its first test. Left: Example of after biface was pulled off metal foreshaft with pine pitch breakage.

Strength Test Data

Metal Foreshaft / Ochre Pitch	Total Haft Weight	Pounds of Force	Weight of Pine Pitch in Notch
Test 1	351g	58lbs	3.1g
Test 2	351.7g	58lbs	3.9g
Test 3	351.3g	48lbs	3.5g
Test 4	351.8g	50lbs	4g

Metal Foreshaft / Insect Lac	Total Haft Weight	Pounds of Force	Weight of Insect Lac in Notch
Test 1	350g	54lbs	2.2g
Test 2	349.6g	50lbs	1.8g
Test 3	350.4g	22lbs	2.7g
Test 4	350.2g	28lbs	2.5g
Test 5	350.2g	44lbs	2.5g



Hafts set outside during weathering process

Effects of Weathering on Adhesives

- ❖ A set of six hafted projectile points were laid outside for four months to observe how they changed over time and how it affects the condition of the adhesive.
- ❖ Hafted points set out on October 5, 2022 until February 14, 2023
- ❖ Every two weeks hafts were sprayed with water if there was no real precipitation forecast. By December natural rain was frequent enough.
- ❖ Four different versions of pine pitch were used that had red ochre, deer droppings, or neither combined with charcoal and pine resin. Only one haft was made of lac due to lack of resources. Another haft was wrapped in sinew.

Results + Observations

- ❖ Force to pull bifaces off its notch was higher than expected. Estimations prior to tests were 5 to 10 pounds.
- ❖ Lac was around the same strength as the pine pitch recipe used all hafts with lac used at least 1 less gram of lac than pine pitch.
- ❖ Although insect lac is harder to source in the present it requires less processing than pine pitch since only a heat source is needed to use lac for hafting.
- ❖ Lac may not be able to be heated multiple times causing it to become brittle.
- ❖ When heated lac retains heat longer than pine pitch and acts like rubber cement as it is a polymer.
- ❖ Pine pitch is more pliable and melts unlike lac which can hold up to being set in the sun better.
- ❖ Pine pitch to deteriorated at a faster rate than lac which was more resistant to the elements. Pine pitch recipe that was used for strength tests had deteriorated the most.

Future Work

More tests should be done with different recipes of pine pitch as time and resources allowed for minimal tests. Develop a more reliable way to measure the strength of adhesives and its other properties. As well as looking into a wider range for the use of these adhesives in the archaeological record.

Reference + Acknowledgments

Pool, Marilen and Christina Bisulca. 2016. Use of Insect Lac in Ancient and Modern Cultures in the American Southwest. Poster presented at the Cross-disciplinary Symposium on Arid Environments Research, April 27, 2016. University of Arizona. NSF REU Award No. 1851763