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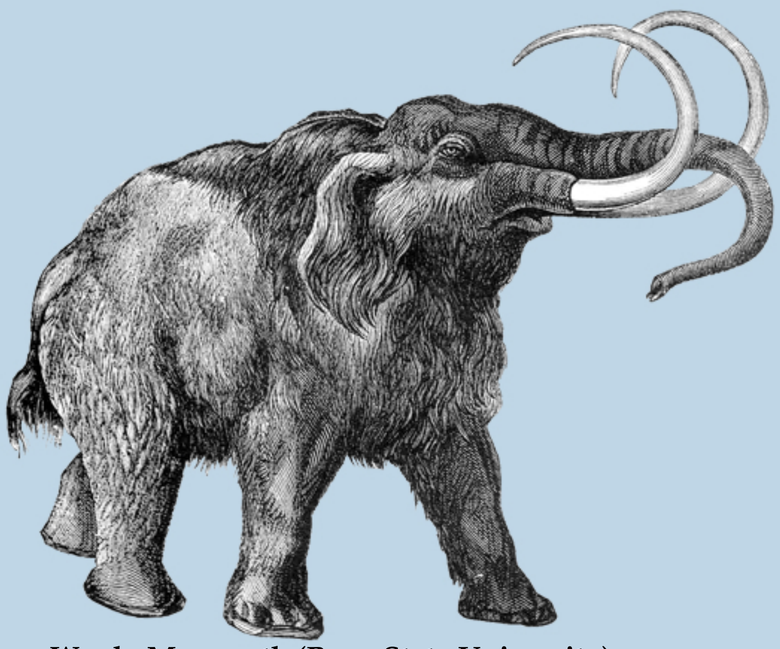
Examining the Effect of Relative Humidity on Mammoth Molars



Wooly Mammoth (Penn State University)

Abstract

Due to their structure, mammoth molars are are very sensitive to fluctuations in relative humidity (RH) and are potentially damaged by such changes. Upon excavation, mammoth molars often undergo rapid acclimatization to the ambient RH, with resulting delamination and cracking observed. To further understand the changes which occur during significant drops to low RH, a single cycle was undertaken from ambient RH to 11%RH. Dimensional changes and crack propagation were measured. A survey of current storage conditions for natural history collections was undertaken, to better understand current practices and propose preventative steps.

Side View of tooth 406.955

Experiment

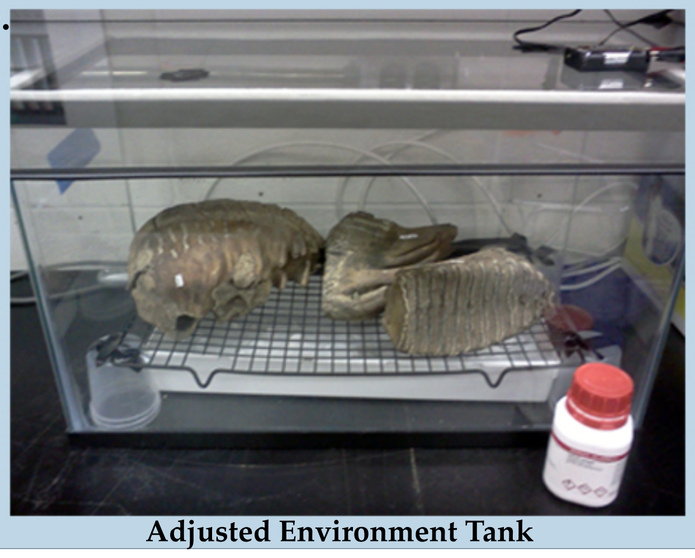
Three mammoth molars were obtained from the Yukon Paleontology Program (Whitehorse).

Pre-existing cracks were photographed and widths measured.

Teeth were placed in an 11%RH chamber (environment adjusted using desiccated LiCl salts).

Weight change was measured over 81 days until 90% of an extrapolated end weight was achieved.

Teeth were photographed and crack widths re-measured.

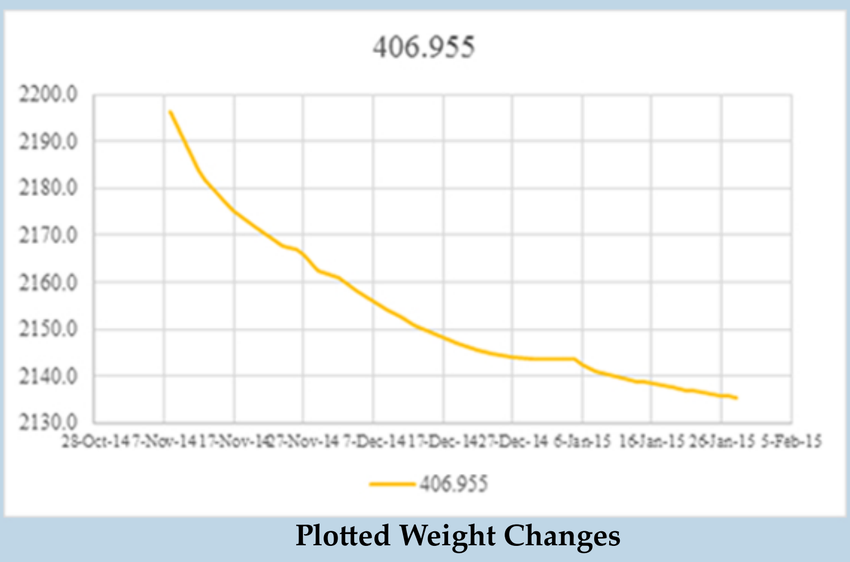


Adjusted Environment Tank

Analysis

Weight values were collected for a period of 81 days.

Detailed crack measurements were taken before and after the experiment.



Plotted Weight Changes

Tooth 406.957 Measurement Comparisons

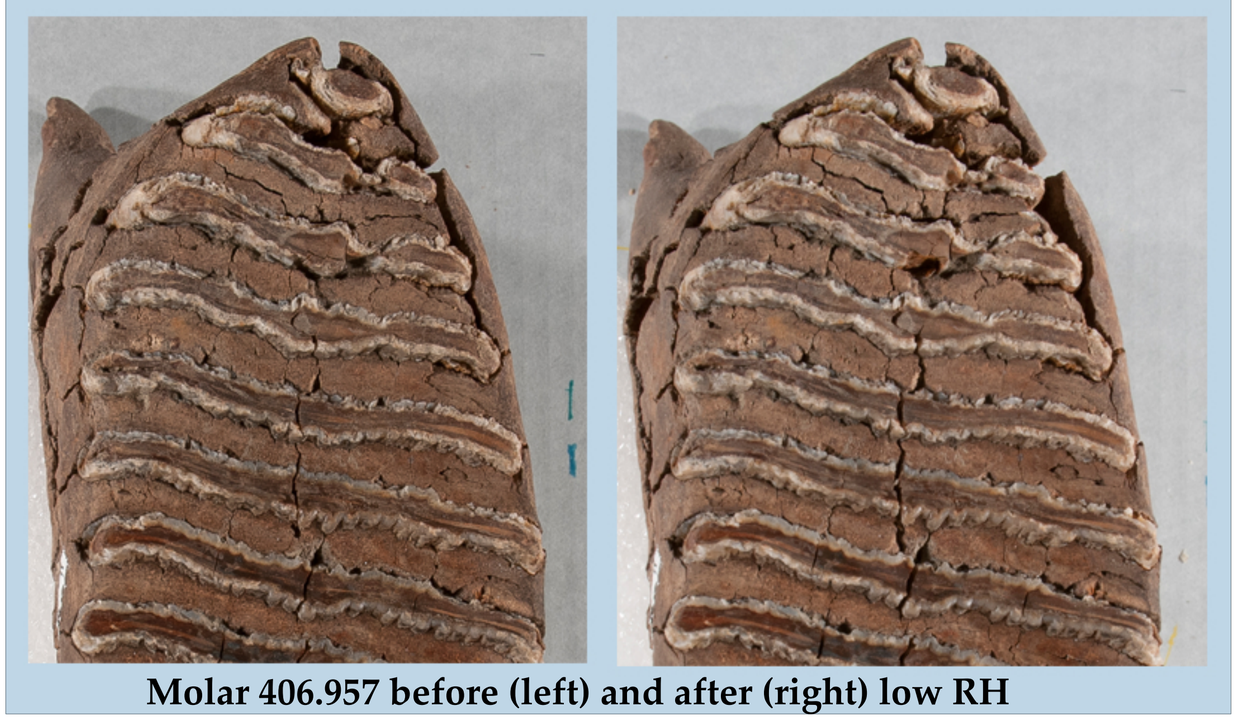
	Initial	End	Change	% Change
Weight	1149.1g	1119.3g	29.8g	-3%
Crack 1	1.0mm	1.1mm	0.1mm	+10%
Crack 2	1.8mm	3.6mm	1.8mm	+100%
Crack 3	2.4mm	2.9mm	0.5mm	+21%
Crack 4	1.1mm	1.3mm	0.2mm	+18%

Results

The three mammoth molars collectively lost 13.3g of powdered and fragmented material.

Previous cracks widened at differing rates.

Surveys of North American and European collections show that many mammoth molars in collections undergo fluctuations of RH +/-10% outside the normal storage conditions, lasting longer than one week.



Molar 406.957 before (left) and after (right) low RH

Conclusions

Physical measurements indicate widening of cracks.

There was a measurable loss of material from the three molars, including powder and fragments.

This supports that rapid exposure to a low 11%RH environment produced a permenant change.

Mammoth molars housed in uncontrolled environments will undergo damage comparable to that observed in this study.

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