OPPOSITION TO PROPOSED REVISIONS TO RULE 4(d) FOR THE AFRICAN ELEPHANT 50 CFR Part 17

The Fish and Wildlife Service includes the following statement in reviewing the regulatory background revising the rule for the African elephant:

> "In November 2013, the Service destroyed nearly six tons of contraband African and Asian elephant ivory that had been either seized at U.S. ports or as part of law enforcement investigations over the past 25 years for violation of wildlife laws."

Nowhere in the long preamble to the proposed rule change has the Service offered any evidence that the ivory crushed had been tested or professionally examined to determine that all six tons destroyed were, in fact, African elephant ivory (*Loxodonta Africana*). Does the Service really pretend that no legal ivory from walruses, boars, warthogs, mammoths or mastodons had been confiscated in the 25 years?

Put another way, how can the Service be trusted to enforce the new Rule 4(d) objectively, given its past disregard for the potentially important historic, cultural, artistic, and scientific artifacts that it destroyed because it wanted "to send a message"? (See Federal Register July 29, 2015 p. 45159). It is imperative that the proposed rule provide meaningful protection for all such artifacts in the future.

> **The proposed revision to Rule 4(d) ought to be further amended to require that any item taken by the US Fish & Wildlife Service, as part of an investigation or operation of a potential Rule 4(d) violation, be subjected to either a panel of experts and/or scientific tests to determine the type and age of the ivory in question.**

As the accompanying report on "Determining the Type and Age of Ivory" indicates, the Shvedchikov Ivory Differentiation Method (SIDM) seems worthy of further study by the USFWS as a useful non-destructive, non-invasive, inexpensive and relatively quick method of determining both the *type* and *age* of different types of ivory and popular ivory substitutes to avoid destroying culturally valuable ivory in the future. The Ivory Education Institute offers its cooperation to the USFWS in furthering this research.

For the Ivory Education Institute

Adolf P. Shvedchikov, Ph.D.
September 10, 2015

IVORY'S CONTRIBUTIONS TO THE PAST AND ITS SIGNIFICANCE IN THE FUTURE ECLIPSE ANY UNREASONABLE OR INEFFECTIVE RESTRAINTS ON ITS TRADE OR MOVEMENT.

INTERNATIONAL IVORY SOCIETY POLITICAL ACTION NETWORK

DETERMINING THE TYPE AND AGE OF IVORY

The Shvedchikov Ivory Differentiation Method

Political Action Network/
International Ivory Society
Ivory Education Institute

Research Conducted by Adolf P. Shvedchikov, Ph.D.

In 2014, the Ivory Education Institute of Los Angeles asked Dr. Adolf P. Shvedchikov, the undersigned retired Chief Scientist of the Low Temperature Plasma Chemistry Laboratory at the Institute of Chemical Physics of the Russian Academy of Sciences in Moscow, if he could develop a non-destructive, non-invasive, inexpensive and relatively quick method of determining both the *type* and *age* of different varieties of ivory and popular ivory substitutes.

After studying the problem in Moscow and Los Angeles, after consultation with other scientists, and after considering all of the options that might be employed, Shvedchikov determined to create a desorption protocol that would work consistently on different types of ivory — including elephant, walrus, whale, narwhal, hippopotamus, warthog, and boar — as well as on such popular ivory substitutes as giraffe, camel, and cow bone, and on plastics, clays, and seeds.

The principal results of more than 500 individual experiments on different samples conducted over more than 1000 hours of laboratory time are as follows:

- All ivory, but not all ivory substitutes, desorb moisture over time.
- Different types of ivory consistently desorb moisture at different rates.
- The greater the amount of time between the moment the ivory is taken from its source, the *slower* the rate of desorption.
- The lesser the amount of time between the moment the ivory is taken from its source, the *faster* the rate of desorption.

These results are illustrated in Graphs 1, 2 and 3 accompanying this statement. Graphs 4 and 5 show:

- Different *types* of ivory and bone may be determined by the rate and percentage of desorbed moisture.
- Equally significant, if no desorption is detected over a 10-hour period, the material is 99% certain to be a plastic material rather than ivory or bone.

The final result of the first round of experiments are summarized on Graph A.

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In order to achieve these results, standard plates of each type of ivory and ivory-substitute material were created. Each plate measured approximately 2mm in thickness. These plates were then stored at room temperature (approximately 25°C/77°F) in an enclosed vessel in an atmosphere of saturated water vapor at 23.7mm of mercury for a duration of 16 to 18 hours.

Each plate was then weighed on a precision electronic scale with a capacity of 200g and a capability of differentiating to a thousandth of a gram the amount of moisture it had absorbed. The initial percentage of absorbed water was determined by dividing the difference between the new weight and the weight of the plate prior to being placed in the enclosed vessel. Then, systematically, each hour over a period of 10 to 12 hours, the samples were reweighed and the results recorded. This indicated the amount of moisture desorbed from each plate between each weighing.

> *For example, if a sample elephant ivory plate — identified by its distinctive grain pattern called Schreger lines — with an initial weight of 1.0 grams lost 0.036 grams of weight between Hour Four and Hour Six of the experiment, the result was expressed as a loss rate of 3.6%. Using a percentage calculation allows a consistent comparison of the relative amount of desorbed water over any number of samples studied during an established period of time.*

The Shvedchikov Ivory Differentiation Method (SIDIM) effectively identified each type of ivory — elephant from walrus, walrus from hippo, and so on — by the *rate* of its desorption of water vapor. Graph A shows this desorption pattern clearly.

Then with samples of the *same* type of ivory, the process was repeated to determine the age of each. To be sure that our method was reasonably accurate in terms of the Carbon 14 standard for determining the age of various specimens, the Ivory Education Institute engaged the services of University of Georgia's Center for Applied Isotope Studies. The Institute sent samples of two different objects that had been SIDM tested: (1) A small plate of elephant ivory rated as "YOUNG" — in the 25 to 50 year range; and (2) a fish-shaped gambling token found in an ivory-inlaid Persian box that had tested as "OLD" — more than 100 years old. Dr. Alexander Cherkinsky, Director of the Auburn center, reported on May 26, 2015 that the "the most likely range for the [age of the] plate is between February 1972 and December 1973 and for the old fish between 1728-1804." The material used in the plate turns out to be just over 40 years old and the ivory used to shape the fish probably came to an Indian workshop more than 250 years ago, both ages well within the parameters determined by the Shvedchikov Ivory Differentiation Method.

Respectfully submitted

September 9, 2015

Adolf P. Shvedchikov, Ph.D.

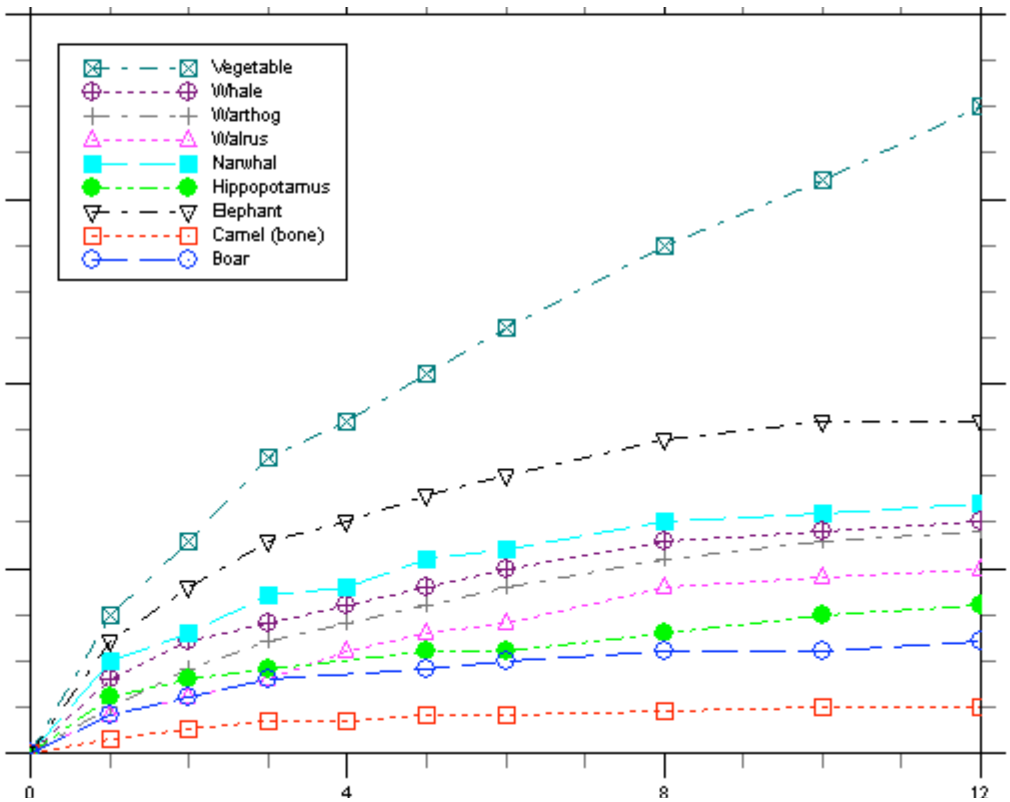
Graph A: SUMMARY FINDINGS OF THE AGE OF ELEPHANT IVORY AND TYPE DIFFERENTIATION OF OTHER IVORY AND IVORY SUBSTITUTES UTILZING THE SHVEDCHIKOV IVORY DIFFERENTIATION METHOD

3.6	
3.5	
3.4	ELEPHANT IVORY — 50 YEARS OLD
3.3	
3.2	VEGETABLE IVORY
3.1	
3.0	
2.9	
2.8	ELEPHANT IVORY — 70 YEARS OLD
2.7	
2.6	
2.5	
2.4	
2.3	ELEPHANT IVORY — 100 YEARS OLD
2.2	
2.1	
2.0	
1.9	
1.8	NARWHAL IVORY
1.7	ELEPHANT IVORY — 120 YEARS
1.6	PIG BONE
1.5	
1.4	WHALE TOOTH
1.3	ELEPHANT IVORY — 160 YEARS
1.2	WARTHOG IVORY
1.1	
1.0	GIRAFFE BONE
0.9	WALRUS IVORY/HIPPO TOOTH
0.8	ELEPHANT IVORY — 200 YEARS
0.7	BOAR IVORY
0.6	
0.5	ELEPHANT IVORY — 210 YEARS OLD
0.4	COW BONE
0.3	CAMEL BONE
0.2	ELEPHANT IVORY — 230 YEARS
0.1	
^^^^^	
0.01	PLASTIC

This graph, presented against a drawing of the Chicago Water Tower, illustrates the age and type of material by its desorption rate. The desorption rate is the percentage loss of moisture at room temperature over a three hour period. Therefore, if an unknown material is shown to lose 2.3% of its moisture content over three hours, there is a 90% or better probability that the material is elephant ivory of more than 100 years of age.

Graph 1: DESORPTION RATES OF IVORY AND IVORY SUSTITUTES

Desorption of Moisture (in Percentages)

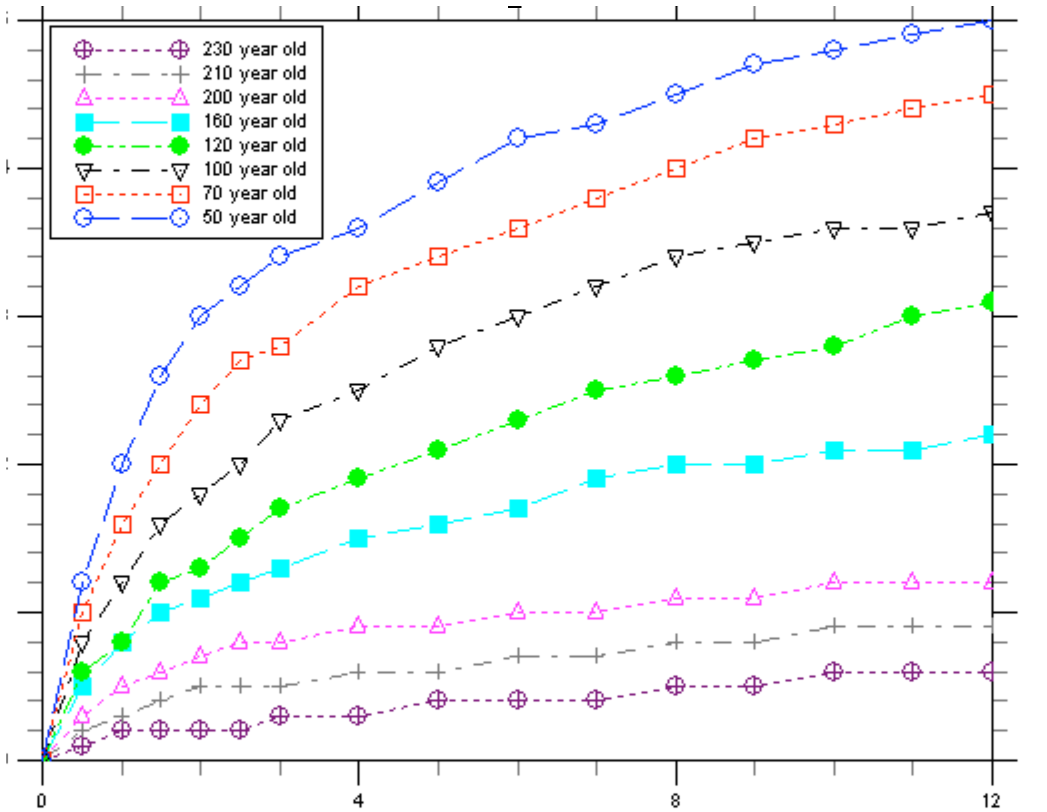


Length of Time for Desorption of Moisture (in Hours)

This graph show the wide range of desorption rates for different types of ivory and ivory substitutes. It also indicates that the divergence of desorption rates becomes clear after two hours and remains relatively constant for the next several hours. This suggests that the rate of desorption of similar sized samples will serve as a reliable means of identifying the source of the material.

Graph 2: DESORPTION RATES OF ELEPHANT IVORY BY AGE

Desorption of Moisture (in Percentages)

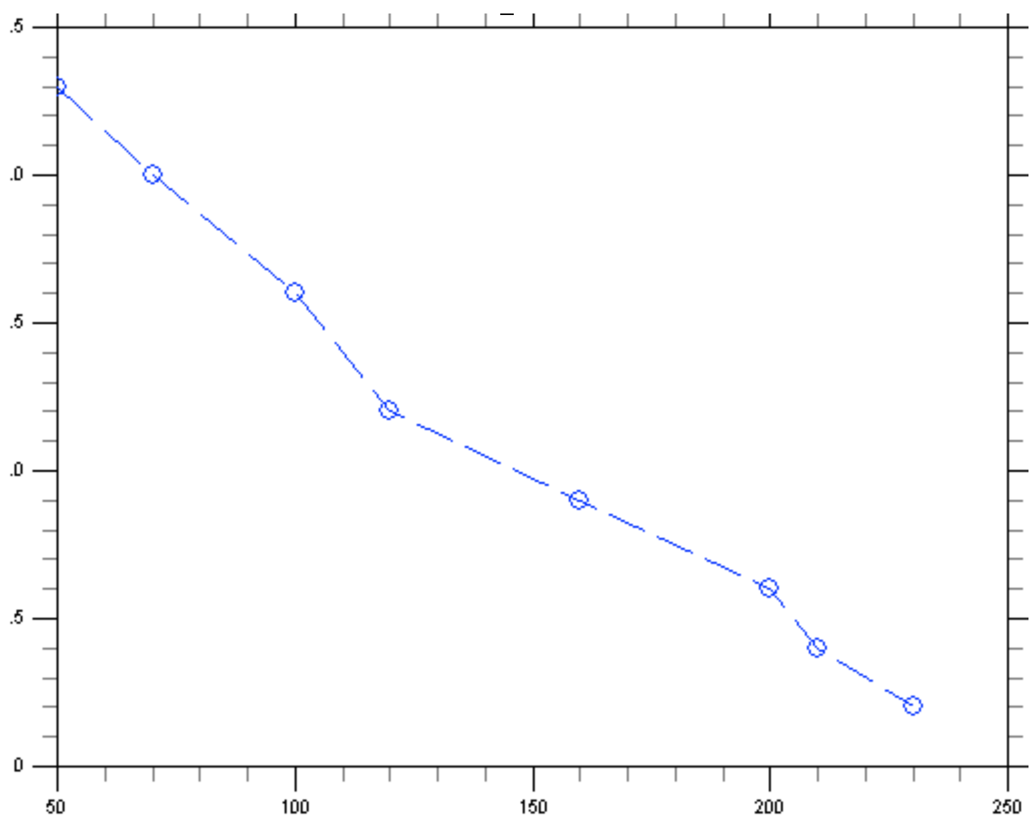


Length of Time for Desorption of Moisture (in Hours)

Desorption of moisture occurs at different rates depending on when the material was believed to have been taken from the animal. Carbon dating was used to establish an age base line for two of the eight samples charted here. The rate of desorption moves from slower to quicker as the samples become younger in age. Again after approximately two hours, a clear differentiation in age becomes evident. The estimate of a sample's age has a current margin of error of 10%. Samples used to conduct the experiments charted in this graph were provided by David Boone, Peter Driscoll, Ron Fromkin, Godfrey Harris, Norman Sandfield, and Spencer T. Thornton.

Graph 3: AVERAGE DESORPTION RATE OF ELEPHANT IVORY BY AGE

Rate of moisture desorption (in Percentages per Hour)

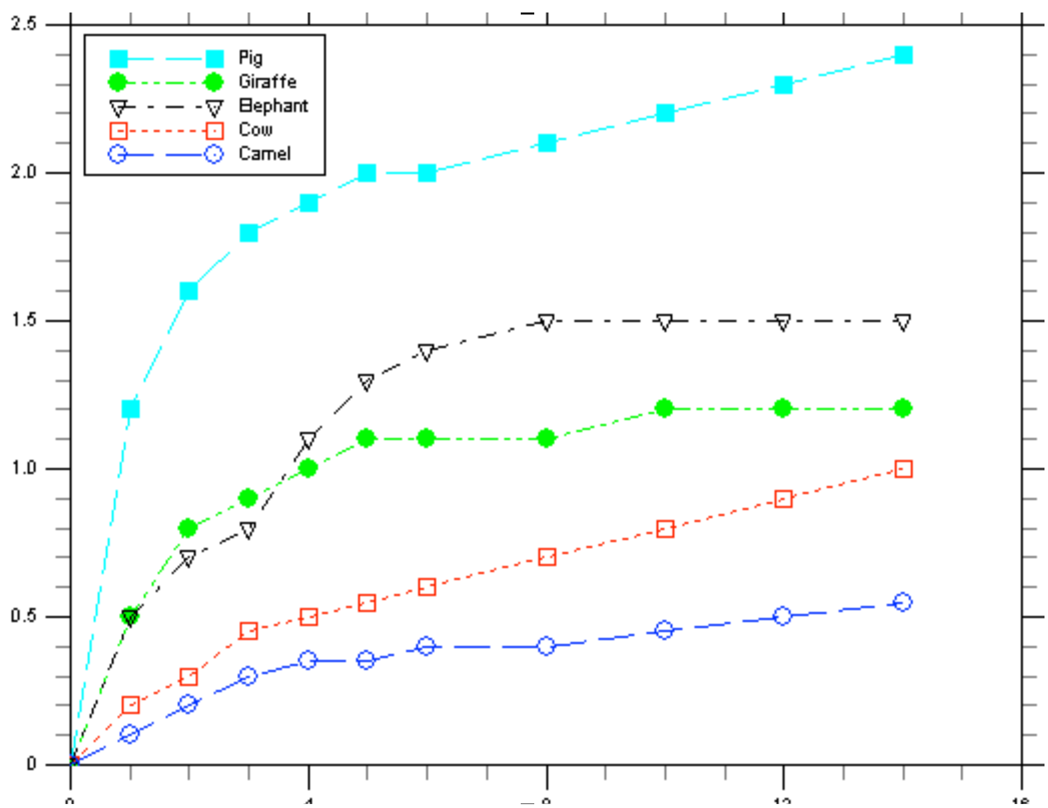


Length of Time for Desorption of Moisture (in Hours)

This Graph shows the *average* desorption rate for elephant ivory of different ages. As the samples become older, they desorb moisture at a slower rate. Note the curve moves from higher rates of desorption to slower rates. If, for example, a sample is shown to have a desorption rate of 1.7% over a two hour period, the sample is likely to be about 90 years of age (with a current margin of error of +/-10%.)

Graph 4: DESORPTION RATE OF BONES

Desorption of Moisture (in Percentages)

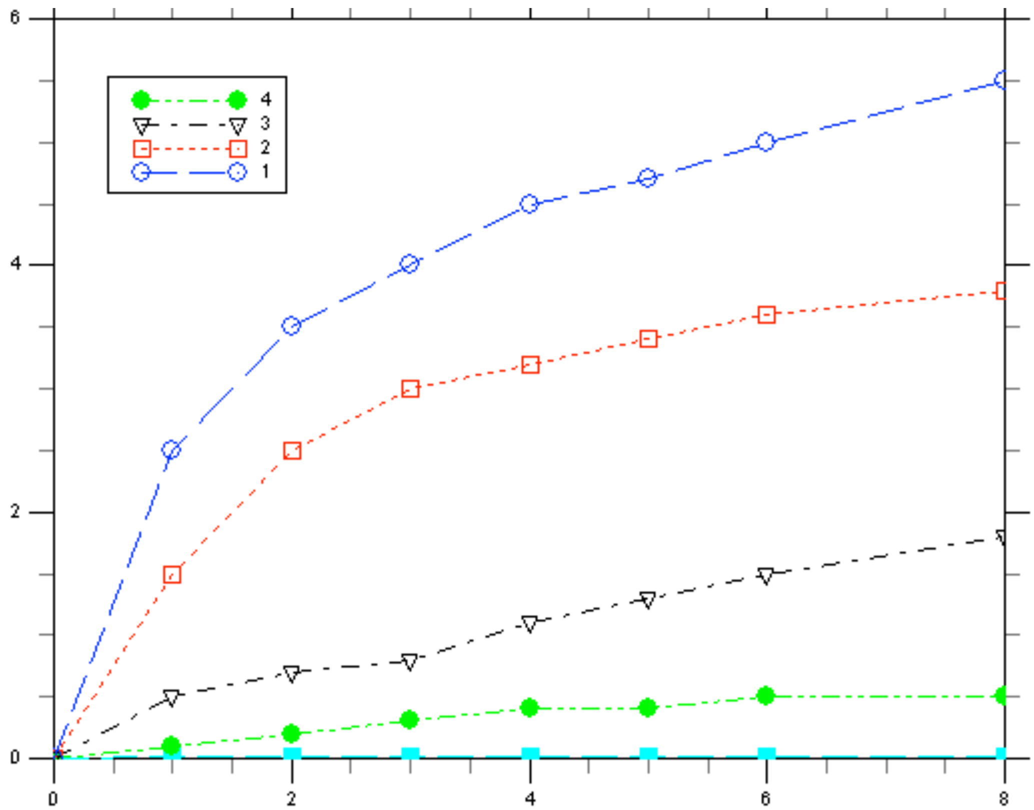


Length of Time for Desorption of Moisture (in Hours)

This graph shows the desorption rate for different types of bones. Note that bone has a lower rate of desorption than ivory. In brief, all types of ivory average a rate of desorption of one to two percent over a two hour period while various bones desorb moisture at a rate of two/tenths of a percent to one percent over the same time period. Put another way, ivory's average rate of desorption is 150% faster than bone. So rate of desorption can not only reliably and consistently differentiate the age of a sample, but it can also differentiate between various kinds of ivory or ivory substitute material.

Graph 5: DETERMINING TYPE OF SAMPLE

Desorption of Moisture (in Percentages)



Length of Time for Desorption of Moisture (in Hours)

This chart shows how the Shvedchikov Method can be used to determine different ivory and ivory substitute materials. Samples 1 through 4 yielded desorption data portrayed in the blue, red, black and green curves above. When these curves are compared to previous results (see Graphs 1-4 herein) Curve 1 corresponds to elephant ivory of about 40 years old; Curve 2 corresponds to elephant ivory about 70 years old; Curve 3 corresponds to known walrus desoption data; and Curve 4 is related to some kind of bone. If the curve has a flat aura – as in the powder blue line at the bottom of the graph above – no desorption was detected. This suggests that the sample is made from plastic. If, on the other hand, moisture desorption is more than 5% in a four hour period, the sample is almost certainly some kind of vegetable ivory.