The losses of gold during cupellation using various makes of cupels

Benjamin Harrison Dosenbach

Follow this and additional works at: http://scholarsmine.mst.edu/bachelors_theses

Part of the Mining Engineering Commons

Department: Mining and Nuclear Engineering

Recommended Citation
THESIS
for the Degree of
Bachelor of Science.
T 217
1910.

THE LOSSES OF GOLD DURING CUPellation
USING VARIOUS MAKES OF CUPELS.

BY
B. H. DORRANCE.

OK - N. P. Manro

10920
There are on the market various cupels. Many of the assay-supply firms sell a "manufactured" cupel, presumably made of bone-ash. The great majority of all cupels used, are made of bone-ash in the assay office itself.

The object of this work is to compare the losses of gold when the various patented, the various manufactured and the ordinary hand made cupels are used.

Four different makes of cupels were used.

No. 1. A manufactured bone-ash cupel made by the Denver Fireclay Co.

Diameter 2\(\frac{1}{4}\)".

Weight 4.2 gm.

No. 2. A manufactured bone-ash cupel from the Henry Heil Chemical Co.

Diameter 2".

Height 30 gm.

No. 3. A patented "organite" cupel.

Diameter 2\(\frac{1}{4}\)".

Weight 62 gm.
No. 4. A hand made bone-ash cupel, air dried for five months before using.

Diameter: 5
Weight: 454 gm

Cupels No. 3. had the greatest hardness, and No. 2., No. 1., and No. 4. follow in the order given, as to hardness.

THE PURE GOLD.

Gold already nearly pure was inquarted with four times the weight of silver. The resulting button was then parted with HNO₃ (2H₂O to 1 HNO₃). The gold, after annealing, was sponge like, and could easily be broken up for weighing.

The amount of gold used in each cupellation was between 19 and 20 mgs. Each gold sample was weighed to the nearest 1/100 mgm., and the gold was considered pure.

THE LEAD USED.

Three hundred grams of the sheet lead were scorified to about 10 grams and cupeled. No gold or silver resulted from this test. The lead was therefore used as silver-gold free.
All cupelations were made in a coal fired muffle furnace with ordinary draft.

The cupels were put into the muffle and heated from five to ten minutes, four rows of five each being cupeled at the same time in each muffle. Temperatures were taken after the buttons had started to drive and after they had blicked, giving the average temperature of the muffle during the process of cupelation. The temperatures were taken about 1/4" above the top of the cupels. A Platinum-Rhodium thermo junction being used for this purpose.

The time of cupelation in nearly every case was between 16 and 20 minutes from the time of the start of driving, to the time of blicking.

All beads in the bone-ash cupel after blicking were spherical on a very small axis, and appeared to be much brighter than those in the patented cupels. The beads in the latter cupels seemed to flatten out somewhat, after blicking, and in some instances they seemed to show some indications of a sprouting action but appeared to have been depressed to some extent.
The accompanying tables give the results obtained by the tests performed. The curves show the average loss at each temperature. The average losses with each succeeding temperature is found in Table No.1.

**TABLE NO.1.**

<table>
<thead>
<tr>
<th>Temp.</th>
<th>No.1.</th>
<th>No.2.</th>
<th>No.3.</th>
<th>No.4.</th>
</tr>
</thead>
<tbody>
<tr>
<td>720°C</td>
<td>-----</td>
<td>-----</td>
<td>0.15%</td>
<td>0.35%</td>
</tr>
<tr>
<td>730°C</td>
<td>6.43%</td>
<td>-----</td>
<td>0.16%</td>
<td>-----</td>
</tr>
<tr>
<td>740°C</td>
<td>-----</td>
<td>-----</td>
<td>0.28%</td>
<td>-----</td>
</tr>
<tr>
<td>745°C</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>0.46%</td>
</tr>
<tr>
<td>750°C</td>
<td>0.51%</td>
<td>-----</td>
<td>0.32%</td>
<td>-----</td>
</tr>
<tr>
<td>760°C</td>
<td>0.73%</td>
<td>0.35%</td>
<td>0.23%</td>
<td>0.36%</td>
</tr>
<tr>
<td>770°C</td>
<td>-----</td>
<td>0.45%</td>
<td>0.56%</td>
<td>-----</td>
</tr>
<tr>
<td>780°C</td>
<td>0.72%</td>
<td>0.68%</td>
<td>0.32%</td>
<td>0.48%</td>
</tr>
<tr>
<td>790°C</td>
<td>-----</td>
<td>0.61%</td>
<td>0.63%</td>
<td>0.70%</td>
</tr>
<tr>
<td>800°C</td>
<td>1.91%</td>
<td>0.85%</td>
<td>1.64%</td>
<td>1.35%</td>
</tr>
</tbody>
</table>
CONCLUSIONS.

A comparison of the curves plotted show, that while a loss in the patented is very low, it is also very erratic, giving a small loss at one temperature, and a much greater loss at another temperature.

The loss in the manufactured bone-ash cupels is greater than the loss in the patented cupels and is also very irregular, but follow a more consistent curve, due to increase in temperature, than the patented cupels.

Cupel No.4, which is the hand made bone-ash cupel, shows a much more even loss, due to varying temperatures, also a loss which is lower than the manufactured cupels, and very little higher than the patented cupel.

From the fore-going, it appears, that while the Morganite Cupel gives a slightly smaller loss than the hand made bone-ash cupel, the results are more erratic, and that for practical work the hand cupel is the preferable.