Distinguishing a Folded Over Rim Fin from a Rim Cud

On United States Coins

By Pete Apple

PART I – TWENTIETH AND TWENTY FIRST CENTURY

"A cud is a marginal die break; an error produced when a piece breaks off the edge of a die and involves the rim and at least a little bit of the adjacent field of design."[1] These photos are of a cud on the obverse of a nickel. Note the weak area on the reverse opposite the cud which was the source of metal for the cud.

Photos by Ken Potter

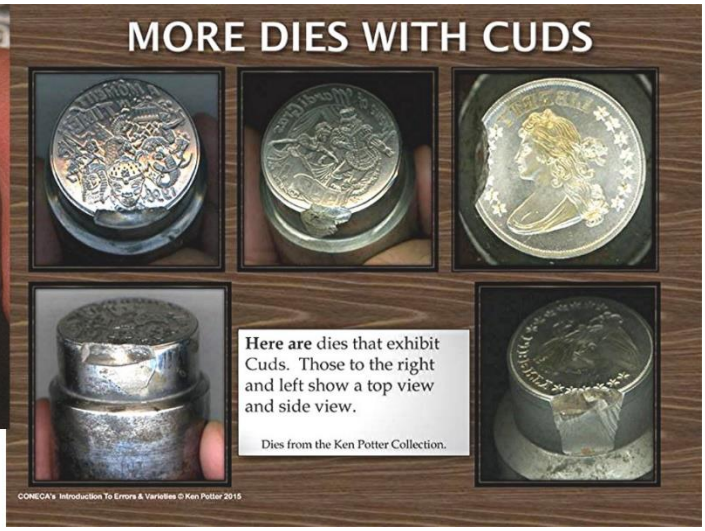
A more fundamental definition is that a cud is a bolus (a small rounded mass of a substance) of semi-degraded food regurgitated from the reticulorumen of a ruminant. I suppose that the numismatic definition evolved to describe the broken piece (bolus) off the side of a die. When the coin was struck by the die with this piece missing, metal on the coin adjacent to the edge of the coin flowed into the vacant area creating a raised area of metal on the coin. This raised metal area came to be defined as a Cud.

"A Rim Cud represents loss of part of the die's rim gutter. On the coin it appears as a raised interruption in the design rim that perfectly tracks the course of the design rim."[2]

(Photos from Error-Ref)

These are photos of dies responsible for cuds. Metal fills the portion of the die broken off thus producing a cud on the coin.

Rim Cud



"A fin is a thin flange that extends vertically from the rim/edge junction of a coin struck within the collar. It is caused by excessive striking pressure or a localized increase in striking pressure caused by slight die tilt. The extra pressure causes coin metal to squeeze into the narrow gap between die neck and collar. Fins can develop on either face or both faces simultaneously. A fin may encircle a coin or may be restricted to one pole. The latter is the kind typically produced by die tilt."[3]

Finning (Photos from Error-Ref)

The Folded Fin starts out vertical and folds inward usually from circulation. You can see the edge of it as separate from the coin; it becomes less apparent with more circulation, but usually maintains the characteristic undulating appearance along the inside edge. Example of a folded over rim fin:

(Photo by and collection of Bry All)

A Folded Over Rim Fin becomes folded after the strike whereas a cud is formed solid with the coin when struck. A Rim Cud will usually exhibit even boundaries rather than the jagged or undulating boundary seen on a Folded Over Rim Fin.

In order to determine whether a feature is a rim cud or a folded over rim fin, I try to envision the die which produced the feature. In many instances, we will find a feature which covers anywhere from 45^{o} to 100^{o} on the rim around the circumference of the coin. This means that the die would need to show a detached bolus of from 45^{o} to 100^{o} around the circumference.

I asked Ken Potter, who has a large collection of dies (some with cuds) if he had ever seen a die with a cud where the piece of the die is not broken off vertically (along the length of the shank), but more horizontally around the circumference of the die for an extended distance of anywhere from 45^{o} - 100^{o} AND limited only to the design rim? He said: "Every single die I have ever owned with Cuds (private mint die and US Mint dies) breaks down the nose or beyond down into the body or shank of the die vertically to a noticeable degree. Obviously some more than others…Of course that is just what I have seen so far. I never know what will turn up. :)"

I have observed that the greater the circumference occupied by the feature, the less likely it is to be from a detached piece of the die and more likely to be from

a folded over rim fin. I estimate that the maximum length for most rim cuds is an arc with a length of approximately ½ of the radius of the coin (30^{o}). Rim cuds beyond this range are possible, but are extremely rare, since a die break on modern coins rarely assumes the form of a circumferential curve. Die breaks are usually shaped more or less straight across and thus begin to encroach on the field of the coin beyond the design rim as they become longer. They are similar in shape to a sliver of wood one would carve off a dowel stick with a pocket knife.

Attempting to attribute such folded over rim fins as this as a very long, extended cud, requires positing the existence of a die with smaller "flakes" broken from the design rim around the circumference. To date no evidence of the existence of such a feature on a modern die has been found or presented. While it may theoretically be possible, the fairly common manifestation of this type of feature and the lack of any dies fracturing in this manner is an argument against the feature being an extended rim cud.

I would propose that if the point of a citrus or rose thorn catches under any part of the edge of the feature, it is then confirmed to be a folded over rim fin.

In the following photo, the length of the cud exceeds ≈ ½ the radius of the coin and is no longer a rim cud because the break has encroached into the area of the field.

Photo by Ken Potter

The discussion up to this point has been applicable to the Twentieth and Twenty First Century only. This is because Nineteenth Century steel used in dies was a different steel.

Today Steel for dies is supplied to the U S Mint by Latrobe Specialty Steel Company, a Division of Carpenter Technology. The steel alloys are Alloy 52100 for small diameter coins and Alloy L6 for quarter on up.

Alloy 52100 is a deep hardening steel alloy used for aircraft bearings and other high stressed parts where good rolling contact fatigue strength is required at temperatures below 400^{o}F. Its typical composition is 1.05% C, 0.35% Mn, 0.30% Sn, 1.50% Cr, and the balance Fe. (Latrobe, 52100) 52100 was developed in the early 1900's, and first used in 1905.

Alloy L6 is a versatile oil-hardening tool steel that is characterized by good toughness and is suitable for tools, dies and machine parts. Its relatively high nickel content gives it greater impact toughness. Its typical composition is 0.70 C, 0.60 Mn, 0.25 Si, 0.70 Cr, 1.40 Ni, and the balance Fe. (Latrobe, L6)

The level of fracture hardness for these steels is more prone to a ductile fracture scenario than a brittle fracture scenario as was the case for 19th Century Steels. This means that the fracture of a die is less likely to travel circumferentially in today's dies than in 19th Century dies. The metallurgical considerations are only one factor to be considered, however. A Metallurgist with whom I consulted indicates that sharpness of corners and initiation point may be more important factors, but they are beyond the scope of this paper and the author's ability to address them.

Except for the addition of Chromium, these alloys approximate the Roberts-Austen alloys in use in the US Mint in the first part of the Twentieth Century.[5]

PART II – EIGHTEENTH AND NINETEENTH CENTURY

The steel used for dies by the US Mint during this period of time was of inconsistent quality.

"It's my understanding that the 18th century US Mint made its die steel itself by heating a bar of iron in charcoal and whacking off a slice at the end. This was

called blister steel. They would then forge the layers together onto an iron bar to make the die. The quality was obviously inconsistent."[6]

Up until about 1878, the US Mint used die steel manufactured in England by Jessup & Co., Ltd. Also, in Philadelphia, the engraver used steel made in Philadelphia, but could not count on consistency in successive orders.

With die steel more prone to brittle fracture than to ductile fracture, fracture patterns are noticeably different during this time period than those we see today.

One notable difference is the presence of rim cuds longer than ½ the radius of the coin.

Some examples:

Reverse 3k to 6k 1845 N-13h (Photo by and collection of Gary Hahn)

(Illustration from Large Cents by Grellman)[4]

Notice the rim cuds significantly exceed ½ the radius in length.

The following coin is interesting in that it shows a series of small breaks connected by a thin line indicating a thin circumferential break or bevel along the outer perimeter of the rim. I think such a thin line found on most 20th century Coins is indicative of a rim fin. Such a fracture pattern is unlikely today to that extent and length (up to roughly 175°).

(Illustrations from Large Cents by Grellman)[4]

A similar coin was recently discussed with some attributing the feature as a folded over rim fin and others as a series of cuds. I think the latter is more likely.

(Photos by and collection of Steven Leary)

Since a rim fin is thought to be caused by excessive striking pressure or a localized increase in striking pressure, the question of the press striking pressure comparison between 19th century presses and those of today arises.

The Bliss Press was used throughout a significant portion of the 20th century (vertical die alignment) and began to be phased out in the last 5 years of the century in favor of the Schuler Press (horizontal die alignment).

Pressures used today are 35 tons for cents and dimes, 50 tons for nickels, 60 tons for quarters, 120 tons for half-dollars and 85 tons for dollar coins.[7]

"The most standard coinage method used in the early days was the screw press…Screw presses were widely used, including at the first Philadelphia Mint beginning in 1792. A screw press used to strike New Jersey Copper coins was sold to the mint in 1794."[8] These Presses exerted 35 tons of pressure.[9] They were used until 1835, when toggle-joint presses which were modeled after the Thonellier and Uhlhorn presses Franklin Peale saw in Europe were installed. The toggle-joint presses all ran on steam.[6] This coining press was first operated in the United States on March 22, 1836. It uses a "toggle joint," a special type of link mechanism which yields great pressure, instead of the screw press. This model could produce 100 coins a minute.[10] The pressure for this press is rated at 152 tons.[11] Original Uhlhorn machines were produced/delivered as early as 1818, initially at the Düsseldorf Mint. Uhlhorn's machine was copied by Thonnelier at the mint in Paris, and Thonnelier's presses were used among other places in France and the United States.[14]

It seems there was ample pressure available to produce rim fins and they are found on 19th century coins in limited quantity. They are primarily found on proof half cents. Sometimes the fin was so pronounced the mint staff filed them down before releasing the coins to the public. They are found not so much on large cents, but sometimes on proofs from the late 1840's and 50's.[12]

Here is one example of a rim fin:

And another example:

The close collar was first used in 1828 for silver coins, and probably in the 1834-38 period for cents. It produced far stronger strikes (by restricting the metal flow of the planchet), higher edges, and sharper borders.[13] Prior to its

introduction, the open collar was in use so rim fins would not be produced in those early years.

<u>A summary of guidelines for determining whether a feature is a folded over rim fin or rim cud(s):</u>

- **For 20th/21st Century Coins: The greater the circumference occupied by the feature, the less likely it is to be a rim cud, and the more likely it is to be a folded over rim fin. The estimated approximate maximum length for most rim cuds is an arc with a length of ½ of the radius of the coin (30^{o}).**
- **If the point of a citrus or rose thorn catches under any part of the internal edge of the feature, it is then most likely a folded over rim fin.**
- **For 19th Century Coins rim cuds may be and are found to be longer than ½ the radius of the coin.**
- **Rim Fins are found on 19th Century coins in limited quantity, but not during the first quarter of the century. They are primarily found on proof half cents and on some Late Date Cents. Folded Over Rim Fins are infrequent.**

Footnotes

1. **http://cuds-on-coins.com/**
   http://www.error-ref.com/cuds/
2. **http://www.error-ref.com/rim-cud/**
3. **http://www.error-ref.com/?s=finning**
4. **The Die Varieties of United States Large Cents 1840 – 1857 by John R. Grellman, Jr. M & G Publications, 2001**
5. **From Mine to Mint: American Coinage Operations and Technology 1833 To 1937 by Roger W. Burdette, 2013, Page 376. (Roberts-Austen was an English metallurgist noted for his research on the physical properties of metals and their alloys. He was appointed Assistant to the Master of the Mint and then Chemist of the Royal Mint (1869), Professor of Metallurgy at the School of Mines (1880) and Chemist and Assayer to the Royal Mint (1882–1902). He developed procedures for the analysis of alloy**

constituents and an automatic recording pyrometer used to record temperature changes in furnaces and molten materials. He became a world authority on the technical aspects of minting coins.)

6. William Eckberg EAC #3395
7. https://www.coinnews.net/2013/09/20/how-the-philadelphia-mint-makes-coins-for-circulation/
8. Whitman Encyclopedia of Colonial and Early American Coins, Q. David Bowers, Whitman Publishing Co., 2009, Page 9.
9. "Her Majesty's Mint" Eclectic Magazine, January 27, 1866, Page 106
10. https://www.fi.edu/history-resources/coin-press
11. "Statistics and Technology of the Precious Metals", Prepared under the direction of Clarence King, by S.F. Emmons and G.F. Beckner, Department of the Interior Census Office, 1885, Page 392.
12. John R. Grellman via Email to Pete Apple.
13. http://numismatics.org/digitallibrary/ark:/53695/nnan167263
14. "Screw presses, Boulton presses, and Uhlhorn presses -The 19th century development in Danish coin striking machinery from an international perspective" by Michael Märcher, Pages 225, 239. From: DOCUMENTS AND STUDIES ON 19th c. MONETARY HISTORY, Mints, Technology and Coin Production; Proceedings of the Round Table of the "Silver Monetary Depreciation and International Relations" program, (ANR DAMIN, LabEx TransferS), Copenhagen, May 28-29, 2015.