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# ELECTRUM INGOT HOARD (2002): A proto-monetary hoard?

*Plates 1–3*

The appearance of a number of electrum ingots on the market over the last year has sparked great interest in the numismatic community. Dated to the seventh or sixth centuries B.C. and described as «proto-money», the ingots of the Electrum Ingot Hoard (2002) appear to provide a missing link in the evolution from the use of metals as money to the creation of coinage. While hoards of uncoined silver are well known, no single hoard of electrum ingots from Asia Minor has ever been reported and very few electrum ingots are known. Alongside the ingots, there appear to be a number of «early» electrum coins associated with the hoard, offering further support to the notion that the hoard is an early electrum hoard of Asia Minor. Taken as a whole, the hoard provides a tantalizing snapshot of the first stages of the history of coinage, as crude pieces of electrum bullion circulated alongside early examples of electrum coins.

The potential importance of this hoard to the study of Greek numismatics cannot be overestimated, particularly if its attribution as an early electrum hoard can be supported; however, there are a number of inconsistencies about the hoard that cast significant doubts about the accuracy of its description as a proto-monetary hoard of Asia Minor. Prior to their dispersal, the ingots and two of the coins were recorded and non-destructive XRF performed on them, to determine their chemical composition. The purpose of this article is to present the results of the chemical analysis and to question the supposition that the ingots are part of an early electrum proto-monetary hoard.

## *Ingots (1 – 32)*

Among the 32 ingots that were viewed prior to dispersal, six were whole pieces ranging in weight from 6.92 to 92.41 grams. All six appeared to be open-cast, with a smooth curved upper surface and a roughly textured bottom. A suggestion has been made that the five of the six were cast according to the Phocaean standard, although this appears unlikely as their weights offer only a very rough approximation of this (92.41, 60.11, 44.42, 19.22, 10.50). Given the precision with which electrum coins were produced, the great divergences from the standard makes the suggestion unlikely.

The remaining 26 pieces are chisel-cut fragments, similar in appearance to *hacksilber*. With the exception of one large fragment, the remaining pieces all fall within a range of 17.47 to 2.35 grams. Among the fragmentary pieces, two sets can be shown to join together (12 and 7, and 13 and 14). As with the whole pieces, most of the fragments appear to be from open-cast ingots, smooth on one side and rough on the other.



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## *Coins (33 – 34)*

The hoard allegedly included several electrum coins, of which two were present with the ingots. Photographs of two additional coins were provided, both of which bore the same types, denominations and dies as the two hoard pieces. The weights of the two observed specimens indicate that they were produced on a Milesian standard of 14.1 grams. The types of both denominations are hitherto unpublished, and the two staters bore crescent-shaped countermarks.

EL stater (Milesian) *PL. 3, A*

*Obv.* Lion protome facing right
*Rev.* Two square punches
a 14.21 *rev.*: crescent countermark
b n/a *rev.*: crescent countermark

EL third (Milesian) *PL. 3, B*

*Obv.* Wheel
*Rev.* Quadripartite incuse punch
a 4.72
b n/a

It is likely that all four coins are crude modern forgeries as they share little in common with genuine early electrum coins apart from their weights. The fabric of the stater is inconsistent with early electrum staters, being flatter and broader than any known specimens. Likewise, a comparison of the reverses of the two Milesian staters reveals that the two punches were joined together, contrary to the practice known from genuine examples. In addition, the reverse of the third bears a quadripartite incuse, unknown in early electrum. Further confirmation can be taken from the chemical analysis of the coins (see below) that demonstrates that the gold content of both specimens is well below the normal range of early electrum coins. Early electrum coins should have a gold content of between 50-75%, whereas the two observed coins have gold contents of 29 and 35% respectively.

## *Chemical Analysis (XRF)*

Owing to the short amount of time the ingots were made available for study, chemical analysis using XRF was the most suitable option available. While the shortcomings of surface XRF are widely known, particularly with regard to the problems of surface enrichment, the technique offered an inexpensive and quick method for gathering an approximation of the chemical composition of the ingots. A more thorough study of the trace elements, using proton activa-

tion (PAA) or proton induced x-ray emission (PIXE), would have been desirable, but was impractical given the constraints of time.

Analysis of the hoard was conducted in Oxford by Dr. P. Northover of the Materials Department and Dr. B. Gilmour of the Archaeology Research Laboratory. The results of XRF analysis show that the composition of the electrum in the ingots differs significantly from that of naturally occurring electrum and that found in early electrum coins. Electrum, when found naturally is generally quite gold-rich, containing only between 5-40% silver and rarely has more than 1-2% copper.[1] Studies conducted on Lydian electrum coins point to a composition of approximately 50-60% gold, 38-48% silver, and 2-4% copper.[2] Vismara's broader study of the composition of early electrum coins indicates a composition of approximately 55-75% gold, 25-45% silver, and 1-4 % copper.[3]

In contrast, the ingots are composed of electrum that falls mostly into the range of 35 - 50% gold, 55 - 65% silver, and 2 - 5% copper. This gold-poor electrum is strikingly different from that seen in early electrum, as can be seen on Chart 1. While a handful of the ingots do have chemical compositions that are similar to early electrum coins, the vast majority fall into a range that is well outside the normal range. The relatively high levels of copper in the ingots is also notable, as few early electrum coins are observed with such consistently high levels.

Based on these results, it is unlikely that the ingots are associated with early electrum coinage. Even keeping in mind Wallace's suggestion that electrum coinage was created in order to help regulate the use of uncoined electrum[4], the disparities between the composition of the electrum ingots and early electrum coins is far too great to reconcile.

## *Conclusion*

As a hoard, the Electrum Ingot Hoard (2002) is highly problematic and tainted by the inclusion of forged coins. It is tempting to condemn the entire hoard as a forgery; however, it would be unwise to do so without further evidence against the ingots. As XRF is incapable of detecting trace elements, more sensitive testing using techniques such as PAA is required to detect whether the ingots contain any unusual inclusions that might indicate their

1 A. Ramage and P. Craddock, King Croesus' Gold: Excavations at Sardis and the History of Gold Refining (London 2000), p. 11. See also E. Pásthory, Investigations of the Early Electrum Coins of the Alyattes Type, in: D.M. Metcalf and W.A. Oddy (eds.), Metallurgy in Numismatics 1 (London 1980), pp. 151-156.

2 M.R. Cowell and K. Hyne, Scientific Examination of the Lydian Precious Metal Coinages, in: A. Ramage and P. Craddock (as n. 1). M.R. Cowell, K. Hyne and P.T. Craddock, Analysis of the Lydian Electrum, Gold and Silver Coinages, in: W.A. Oddy and M.R. Cowell (eds.), Metallurgy in Numismatics 4 (London 1998), pp. 526-538.

3 N. Vismara, Monetazione arcaica in elettro dell'Asia Minore (Milan 1993).

4 R. Wallace, The Origin of Electrum Coinage, AJA 91, 1987, pp. 385-397.

manufacture in modern times. One possibility that deserves consideration is that forged coins were added to a genuine hoard of electrum bullion in order to make it more marketable. Given their similar compositions, the forged coins could have been manufactured by using some of the hoard ingots.

If the ingots are of ancient manufacture, a more probable context for the ingots is with later electrum coinage, notably that which was struck and circulated within the Black Sea region. During the fifth and fourth centuries, electrum continued to be struck by a handful of Greek cities, including Mytilene, Phocaea, and Cyzicus. The latter's coinage was extensive and served as one of the key currencies of the Black Sea and Aegean during this time. While the composition of the electrum coins from these mints started relatively gold-rich, towards the end of the fifth century and in the fourth, the gold content of the coins dropped. Bodenstedt's specific gravity analysis suggests a gold content of approximately 40-2% at Mytilene and Phocaea,[5] and studies of the chemical composition of the electrum coins of Mytilene and Phocaea suggest likewise.[6]

This context fits in well with one of the purported find-spots of the hoard, somewhere in the Black Sea region. Beyond the chemical composition of the ingots, the hoard offers little else for guidance. As with all hoards of uncoined metals, the absence of a datable marker or an archaeological context makes the dating of the material virtually impossible. Had genuine early electrum coins been found with the ingots, the hoard would have provided a crucial missing link between the use of electrum bullion and early coins. In the end, the hoard is without context and datable only by inference.

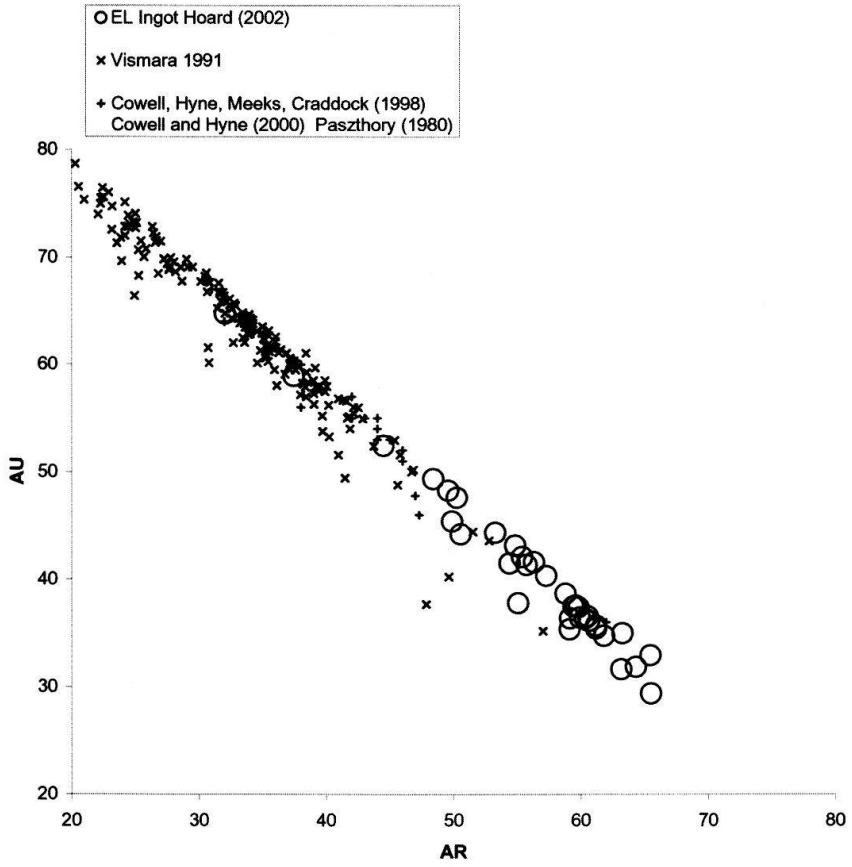
Table 1: Chemical composition of the hoard – XRF

| | *weight* | *Ag* | *Au* | *Cu* | *Pb* |
|---|---|---|---|---|---|
| 1 | 92.41 | 59.59 | 37.56 | 2.85 | 0.62 |
| 2 | 60.11 | 63.18 | 31.62 | 5.20 | 0.36 |
| 3 | 44.42 | 59.82 | 37.38 | 2.80 | 0.42 |
| 4 | 19.22 | 64.33 | 31.84 | 3.83 | 0.46 |
| 5 | 10.50 | 44.51 | 52.42 | 1.11 | 1.95 |
| 6 | 6.92 | 54.41 | 41.51 | 4.08 | 0.56 |
| 7 | 71.12 | 37.44 | 58.91 | 3.65 | 0.59 |
| 8 | 17.47 | 55.09 | 37.79 | 7.12 | 0.75 |
| 9 | 16.91 | 57.28 | 40.33 | 2.38 | 0.63 |
| 10 | 14.95 | 59.15 | 36.36 | 4.49 | 0.62 |
| 11 | 13.59 | 50.28 | 47.60 | 2.12 | 0.52 |
| 12 | 13.55 | 32.05 | 64.74 | 3.20 | 0.86 |
| 13 | 12.28 | 61.20 | 35.43 | 3.36 | 0.56 |
| 14 | 11.36 | 61.20 | 35.67 | 3.13 | 0.62 |

5 F. Bodenstedt, Die Elektronmünzen von Phokaia und Mytilene (Tübingen 1981), pp. 333-339.

6 P.T. Keyser and D.D. Clark, Analyzing and Interpreting the Metallurgy of Early Electrum Coins, in: M.S. Balmuth (e.), Hacksilber to Coinage: New Insights into the Monetary History of the Near East and Greece (New York 2001), pp. 105-126.

| | *weight* | *Ag* | *Au* | *Cu* | *Pb* |
|---|---|---|---|---|---|
| 15 | 10.51 | 54.84 | 43.13 | 2.03 | 0.61 |
| 16 | 9.91 | 56.32 | 41.62 | 2.06 | 0.61 |
| 17 | 9.17 | 65.47 | 32.92 | 1.61 | 0.51 |
| 18 | 9.15 | 48.42 | 49.35 | 2.23 | 0.85 |
| 19 | 8.73 | 59.11 | 35.34 | 5.55 | 0.48 |
| 20 | 8.12 | 55.38 | 42.08 | 2.54 | 0.72 |
| 21 | 8.09 | 53.28 | 44.32 | 2.40 | 0.69 |
| 22 | 7.90 | 61.84 | 34.73 | 3.43 | 0.46 |
| 23 | 6.43 | 58.79 | 38.67 | 2.54 | 0.94 |
| 24 | 6.29 | 59.92 | 36.46 | 3.62 | 0.64 |
| 25 | 6.16 | 50.58 | 44.20 | 5.21 | 0.70 |
| 26 | 5.95 | 59.43 | 37.48 | 3.09 | 0.64 |
| 27 | 5.25 | 60.67 | 36.12 | 3.21 | 0.60 |
| 28 | 4.79 | 60.55 | 36.55 | 2.90 | 0.56 |
| 29 | 4.31 | 60.31 | 36.33 | 3.36 | 0.73 |
| 30 | 4.01 | 49.90 | 45.38 | 4.72 | 0.80 |
| 31 | 3.10 | 55.74 | 41.37 | 2.89 | 0.70 |
| 32 | 2.35 | 49.58 | 48.28 | 2.14 | 0.75 |
| Stater | 14.22 | 65.52 | 29.38 | 5.10 | 0.38 |
| Third | 4.72 | 63.27 | 34.98 | 1.75 | 0.52 |



*Zusammenfassung*

In 2002 tauchte ein ungewöhnlicher Elektron-Fund im Handel auf, bestehend aus 32 Barren und 2 Münzen. Die Barren wurden sofort als prämonetäres Geld gedeutet, das zusammen mit frühen Elektronmünzen umlief. Sollte der Fund echt sein, so hätten wir erstmals einen handfesten Nachweis, dass sich die frühesten Elektronmünzen aus Elektronbarren entwickelten, womit sich unsere Kenntnisse von den Anfängen der Münzprägung von Grund auf revolutionierten.

Hier werden die Resultate der Analysen vorgestellt, die an den Barren und Münzen vorgenommen wurden. Dank XRF war der Nachweis möglich, dass sich die chemische Zusammensetzung der Oberflächen deutlich von den bekannten Standardwerten von Elektronmünzen unterscheidet. Diese Abweichungen werfen Zweifel auf die Echtheit des Fundmaterials. Die beiden Münzen sind äusserst verdächtig, da sie im Aussehen und Stil überhaupt keinen frühen Elektronmünzen ähnlich sehen. Wenn es auch schwierig ist, sich zur Echtheit der Barren zu äussern, so lässst deren chemische Zusammensetzung doch ernsthafte Zweifel aufkommen, dass es sich dabei wirklich um eine Art von prämonetärem Geld handelt, das zusammen mit frühen Elektronmünzen im Umlauf war.

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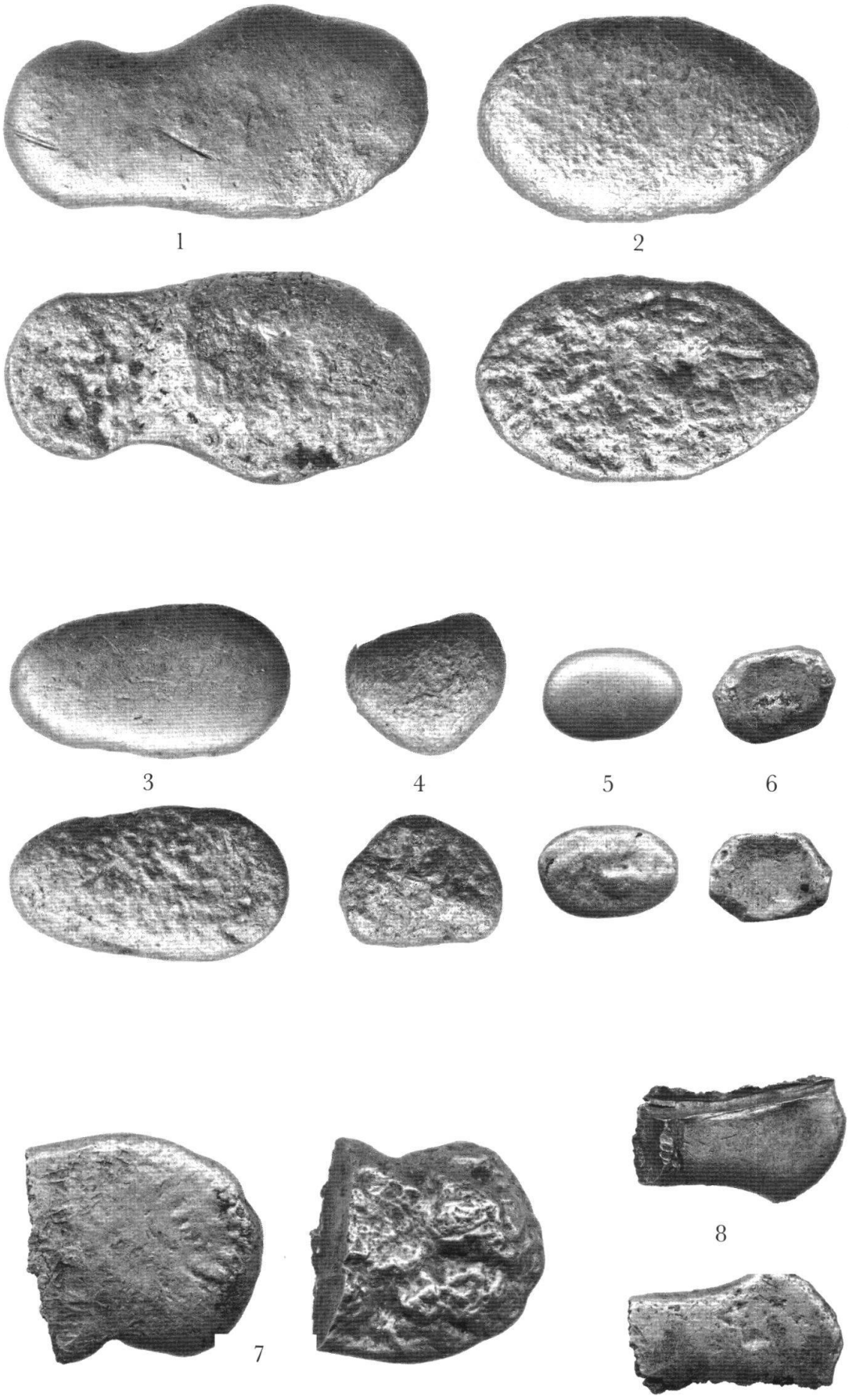
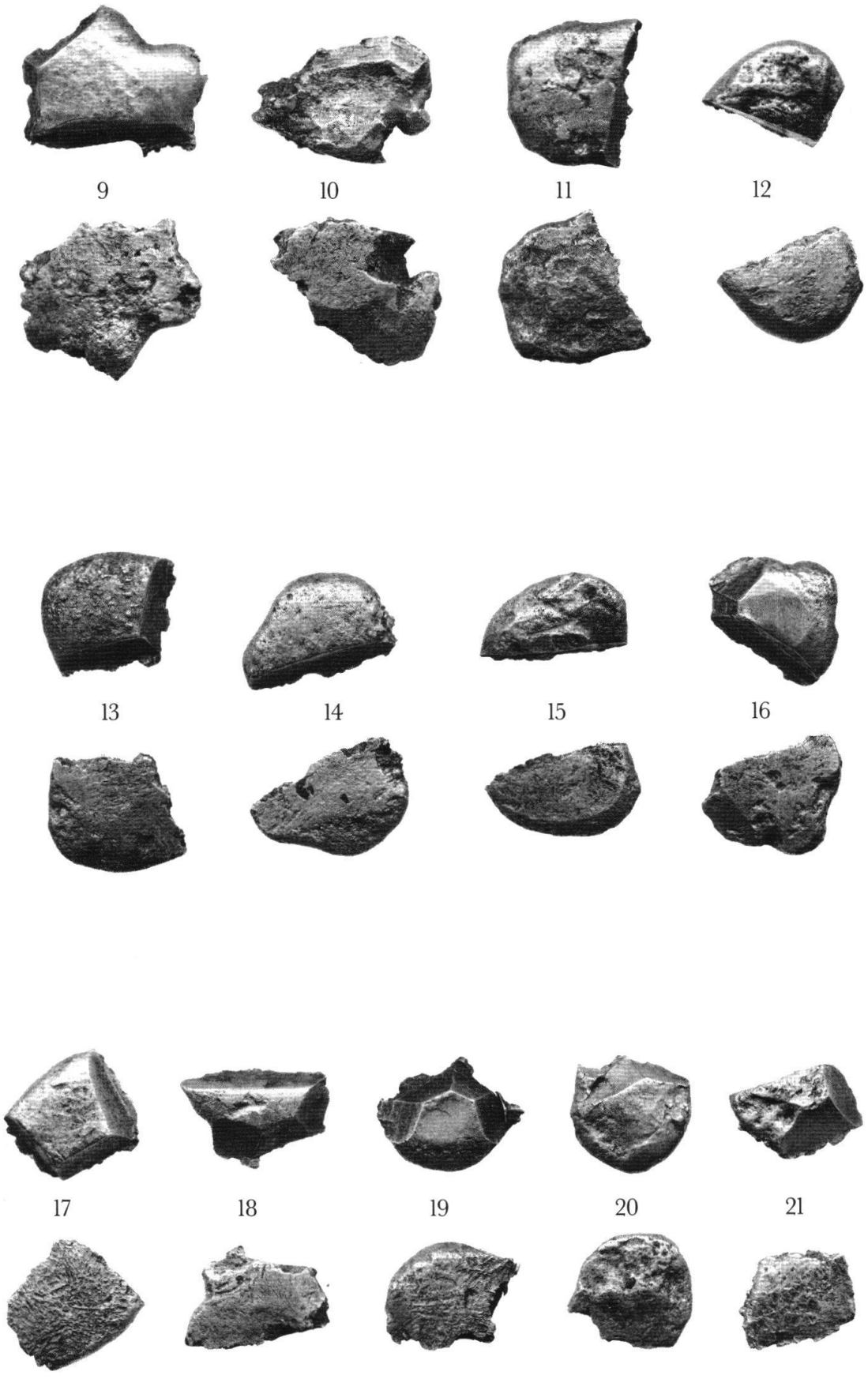
*Editors' Note*

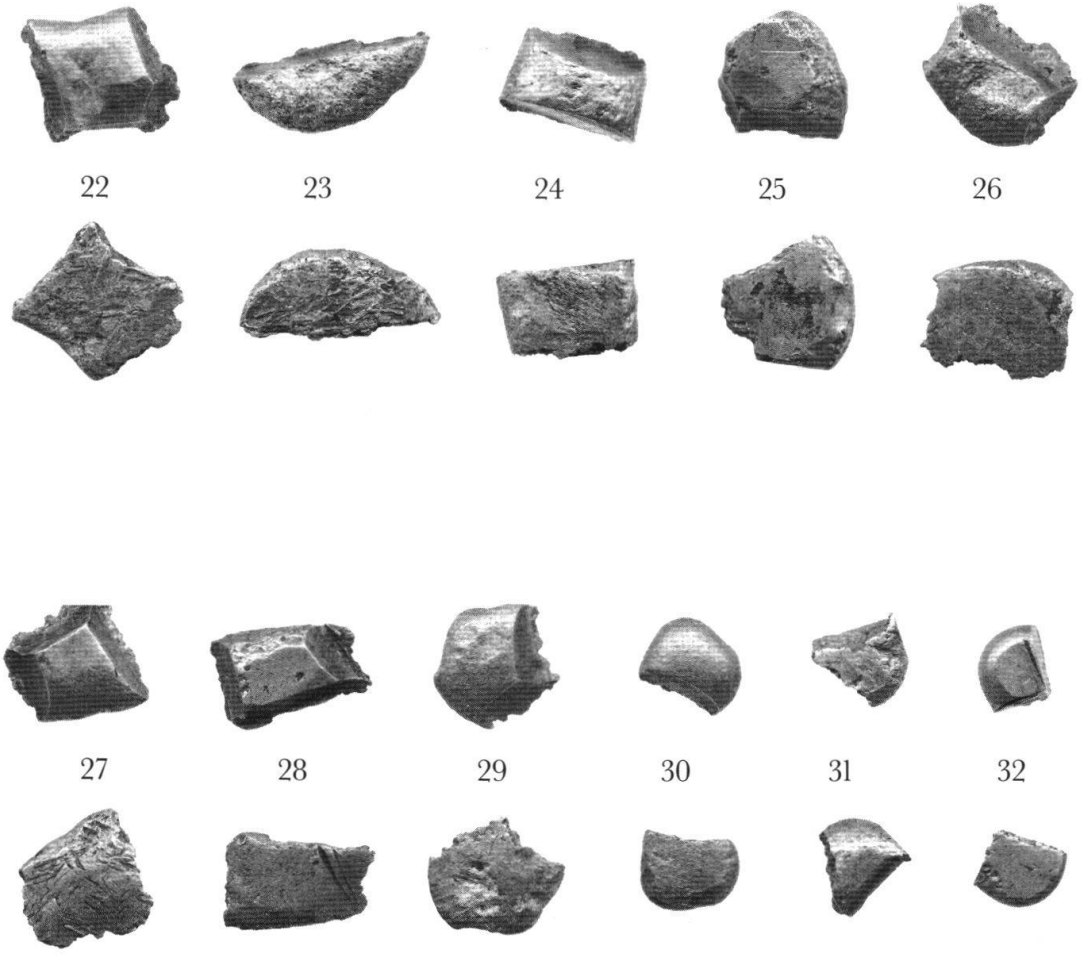
This article was already at the printer's when the catalogue Classical Numismatic Group 66, 19 May 2004, came out, where no less than 24 of the ingots published here are offered as lot 647. It is evident that scientists were given the possibility to analyse the Hoard, but then the material was put on the market, in three groups, without waiting for the results of the tests to be published. Lot 648, the third-stater (here coin B) does not inspire much confidence even in the better illustration.

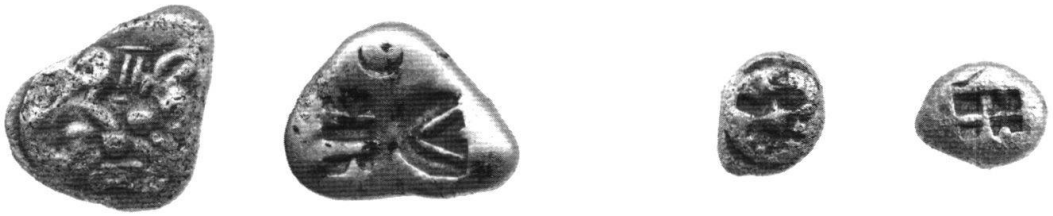



Henry S. Kim, Electrum Ingot Hoard (2002) (1)




Henry S. Kim, Electrum Ingot Hoard (2002) (2)



A B

Henry S. Kim, Electrum Ingot Hoard (2002) (3)