The Gold Coinage of Aksum. Further Analyses of Specific Gravity. A Contribution to Chronology

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INTRODUCTION

IN *Metallurgy and Numismatics*, vol. ii, Munro-Hay, Oddy, and Cowell, report further analyses of the gold coinage of Aksum,[1] thus adding to the data published in 1980 by Oddy and Munro-Hay.[2] They have demonstrated convincingly that measurement of specific gravity and of the gold content shows an overall progressive debasement from the earliest coins of Endybis, which were struck at the end of the third century AD from very fine gold, to the last, some three hundred years later, of Gersem. With collateral evidence from archaeological excavations and from inscriptions, the debasement appears to be a valuable means of determining the order of the kings. Munro-Hay, Oddy, and Cowell have published 158 coins. We have examined a further thirty-six coins in a private collection in Oxford. Six coins are identical with coins examined by Munro-Hay and Oddy (Aphilas *A*/3, J-J 79 = M-H 11; Ousanas I *A*/1a/b (*A*/1c), J-J 112 = M-H 26; Ezanas Christian *A*/1, J-J 77 = M-H 47; Ebana *A*/1, J-J 68 = M-H 90; Anonymous *A*/1, J-J 67 = M-H 54; Anonymous *A*/3, J-J 64 = M-H 102). Some (Aphilas 2a; Ezana heathen, new type published in *Num. Circ.* 93 (1985), p. 85; Nezana var *A*/3; Khaleb *A*/, undescribed variants ('*A*/1e', '*A*/3c (iii)', and '*A*/3i') have not been measured in Munro-Hay's survey, and others (e.g. Khaleb *A*/3d and Khaleb *A*/4; Ellagabaz *A*/1; Israel *A*/1; Gersem *A*/2) are sufficiently rare to be worth adding to existing scanty evidence.

METHOD

Specific gravities were measured by the hydrostatic method, using toluene as the immersion liquid (SG = 0·867).

Replicate measurements indicate accuracies of ±0·0001 g. for the weights and ±0·02 for the specific gravities listed in Table 1.

Gold contents were calculated using the empirically determined equation of Oddy and Blackshaw for simple gold/silver alloys,[3] which assumes that the

[1] S. C. Munro-Hay, W. A. Oddy, M. R. Cowell, 'The gold coinage of Aksum: new analyses and their significance for chronology', *Metallurgy and Numismatics*, ii (in press).

[2] W. A. Oddy, S. C. Munro-Hay, 'The specific gravity analysis of the gold coinage of Aksum', *Metallurgy in Numismatics*, i (RNS, SP 13, 1980), pp. 73–82, plates 2–4.

[3] W. A. Oddy, S. M. Blackshaw, 'The accuracy of the specific gravity method for the analysis of gold alloys', *Archaeometry*, 16 (1) (1974), pp. 81–90.

TABLE 1

Specific Gravities of Aksumite Gold Coins

J-J Acc. No.	Munro-Hay reference[4]	Weight (grammes)	SG	Gold Content (%)
ENDYBIS				
113	*A*1	2·2640	18·74	95·9
206		2·6724	18·46	94.1
63		2·6912	18·37	93·5
13		2·7728	18·23	92·5
APHILAS				
115	*A*1	0·3349	18·16	92·0
116	var. *A*1	0·2538	18·04	91·2
76	var. *A*1	0·3305	18·03	91·1
191	*A*2a	2·6867	18·09	91·5
79	*A*3	1·3936	17·88	90·0
OUSANAS I				
112	*A*1a/1b	2·0325	17·86	89·9
EZANAS (Heathen)				
64	*A* pNC	1·7935	17·62	88·1
111	*A*1a	1·7930	17·30	85·7
EZANAS (Christian)				
77		2·1047	17·85	89·8
EON				
5	*A*1	1·5860	17·35	86·1
Anonymous				
148	*A*1	1·5971	16·49	79·2
67	var. *A*1	1·6529	16·46	79·0
EBANA				
21	*A*1	1·5826	17·25	85·4
65	var. *A*1	1·4568	17·01	83·5
68	var. *A*1	1·5804	16·36	78·1
Anonymous				
69	*A*3	1·6244	16·29	77·5
OUSAS				
66	*A*1a	1·5693	16·11	75·9
9	var. *A*1a	1·6228	15·68	72·0
OUSANA				
207	*A*1	1·6204	15·91	74·1
78	*A*1	1·5798	15·68	72·0
NEZANA				
196	var. *A*3	1·6183	15·56	70·9
NEZOOL				
197	*A*1	1·6155	15·52	70·5

J-J Acc. No.	Munro-Hay reference[4]	Weight (grammes)	SG	Gold Content (%)
KHALEB				
208	'A/1e'	1·6069	15·69	72·1
209	'A/3c(iii)'	1·6122	15·78	72·9
19	A/3d	1·4774	16·22	76·9
204	'A/3i'	1·6729	16·00	74·9
205	A/4	1·6554	15·04	65·8
ALLIMIRUIS				
198	A/1	1·6060	14·74	62·7
ELLAGABAZ				
199	A/1	1·4970	13·76	51·6
ISRAEL				
6	A/1	1·5045	14·61	61·3
147	var. A/1	1·4715	14·55	60·6
GERSEM				
201	A/2	1·2846	14·21	56·8

coins contain no internal voids and that constituents other than gold and silver are present in negligible amounts. See Munro-Hay, Oddy, and Cowell (op. cit. in n. 1) for a discussion of this aspect.

DISCUSSION OF RESULTS

The first column of the Table gives the accession number in the collection, the second the reference to Munro-Hay's Monograph,[4] the third the weight in grammes. The fourth column gives the specific gravity (SG), and the fifth the calculated gold content if the impurity were all silver. We know from other investigators that the main components of the coins tested were Ag and a little Cu.[1] If small amounts of copper are present, the true gold values will be somewhat higher than the values listed in the Table. The references 'Munro-Hay SG' (below) refer to the serial numbers in Munro-Hay, Oddy, and Cowell (cit. in n. 1). It will be seen that the overall pattern is the same as that found by those authors.

The four *Endybis A/1* coins show a scatter of SG from 18·74 to 18·23 (M-H: 19·10 to 18·21). Interestingly, the lightest coin (J-J 113) had the highest SG like Munro-Hay's SG 501 (wt. 2·2640 g, SG 18·74 compared with wt. 2·399 g, SG 19·10).

The three little *Aphilas A/1*, the eighth tremissis, are all from different sets of dies, but the SG is very similar in all three pieces (18·16 to 18·03). J-J 116

[4] S. C. Munro-Hay, *The Coinage of Aksum* (New Delhi and Butleigh, 1984).

weighs only 0·2538 g., but it is on a small flan and its SG is close to that of J-J 76. The J-J 191 *Aphilas A/2a* tremissis was Vaccaro's (V4). It differs in design from *A/2* by having well-balanced, symmetrical lettering on the obverse. The SG (18·09) is close to that of M-H's SG 609 *A/2* (18·12). J-J 79, the *Aphilas A/3*, is the Gebre-Selassie—Tringali—Munro-Hay 11 piece (SG 610). Our weight (1·3936 g) and SG (17·88) are close to Munro-Hay's measurements (wt. 1·394 g, SG 17·91).

Ousanas I A/1c (*A/*1a/1b) (J-J 112 = M-H 26) again shows considerable agreement; our wt. 2·0325 g, SG 17·86; M-H's SG 613, wt. 2·033 g, SG 17·91.

J-J 64, *Ezanas heathen A/* is a type not described by Munro-Hay, but published in *Numismatic Circular* (see above). Both weight (1·7935 g) and SG (17·62) are close to those of J-J 111, an *Ezanas heathen A/1a* (wt. 1·7930 g, SG 17·30). *Ezanas Christian A/1*, formerly Munro-Hay 47 (SG 618), now J-J 77, again yielded comparable figures; wt. 2·105–2·1047 g, SG 17·82–17·85.

It could be argued that the section on *Eon A/1a,b,c* in Munro-Hay's monograph,[4] pp. 88–9, should have been expanded, giving more detailed, separate descriptions similar to those devoted to Khaleb *A/*1–4, pp. 116–24. J-J 5 does not correspond to any of the variants described by M-H. The obverse legend is: (12.00) ✠BAC✠CIS✠BAX✠ACA; the reverse: (6.00) ✠ƷMΣ✠ꟻIↃ✠IAN✠AAΦ. The weight (1·5860 g) and SG (17·35) are comparable to M-H SG 536 and 537.

The two *Anonymous A/1* show very similar SG. J-J 67 is of the type described by Munro-Hay under 'Variants' (p. 90); J-J 148 is of the *A/*1 type described by Munro-Hay. J-J 67 equals M-H 54 (SG 640), and our measurements (wt. 1·6529 g, SG 16·46) are very close to those of Munro-Hay (wt. 1·653 g, SG 16·42).

The three *Ebana* pieces are from different sets of dies. The obverse of J-J 21 and J-J 68 both show the king with a tall crown; on neither does the king have a sceptre, but J-J 68 has a die flaw across the face of the coin. The reverse of J-J 21 shows the king with a short sceptre, J-J 68 has none. J-J 65 obverse has a low tiara, and the king has a sceptre. On the reverse the king carries a flywhisk. J-J 68 equals M-H 90 (SG 629), and our figures again are close to those of M-H (wt. 1·5804 g, SG 16·36, compared with wt. 1·580 g and SG 16·37).

J-J 69, *Anonymous A/3*, equals M-H 102 (SG 636). The correspondence between our weight (1·6244 g) and that of Munro-Hay's group (1·625 g) is close, and our calculated specific gravity of 16·29 is near M-H's (16·25).

The two *Ousas A/1a* pieces are from different sets of dies. J-J 66 has spidery lettering, and on the obverse a mintmark 'o' to the left of the left barley stalk. J-J 9, formerly Brand Collection (part V, lot 305, 1984), has a mintmark '<'. Our measurements are in the same range as Munro-Hay's.

[4] S. C. Munro-Hay, *The Coinage of Aksum* (New Delhi and Butleigh, 1984).

The two *Ousana AV1* pieces, J-J 207 and 78, are from different sets of dies. J-J 207 has on the obverse a mintmark 'Φ' above the tiara, and the reverse legend reads: **BЄVVIXIXΛPIC**. The weight is 1·6204 g, and the SG 15·91. J-J 78 has on the obverse a mintmark '⁘' above the tiara, and the reverse legend reads: **B·ЄDY XAPIC+**. The weight is 1·5798 g, the SG 15·68. The specific gravities are similar to M-H's examples: SG 563–74, of 16·16 to 15·31. J-J 78 is of very pale gold compared with J-J 207, but this may well be an effect of the soil in different environments.

Nezana var. AV3 (J-J 196) is not identical with Vaccaro 47,[5] but differs in minor detail. It was illustrated enlarged in Sternberg's catalogue (20/1 November 1986, lot 243). The 'E' of **BΛCIΛEVC** on the reverse is of a very square design. The bust is more boldly drawn on both sides, and the ribbon more generous than on the Vaccaro coin. Although Vaccaro's weights are not always reliable, the weight he recorded for his 47 of '2G' does not correspond to the weight of the present coin: 1·6183 g.

J-J 197, *Nezool AV1*, has on the obverse a single stem flywhisk, breaking the legend after **OEOYE**, and on the reverse a single strand breaking the legend after **BACIΛE**. The weight and specific gravity are comparable to the findings of M-H for other examples of this coin (SG 578–584).

An undescribed coin of the Khaleb AV1 group, J-J 208, for convenience called *Khaleb 'AV1e'*, has a reverse like M-H's AV1d, but the obverse is different: at 12.00: (Khaleb's monogram) **XΛΛ+H88+AƆIY+ЭVƆ**. Although the arrangement resembles that on M-H's AV1c a little, it is clearly a different coin. It was illustrated in Credit Suisse's Auction 8, 28.10.1987, lot 1544. Its weight is 1·6069 g, the specific gravity 15.69. This compares with M-H's SG 586 AV1d, weight 1·593 g and SG 16·34. An undescribed coin of the Khaleb AV3 series, J-J 209, for convenience called *Khaleb 'AV3c(iii)'*, has an obverse resembling that of AV3c(ii): **+AH88**[...] **IΛƆVƆ**. The flan is narrow, and two or three letters of the legend have not been stamped. The reverse legend is related to that of AV3 and AV3a, but is different: at 12.00: **++VIOƆOЭ~ЭИA=**. It is not from the same dies as Anzani 137 and 138, or Vaccaro 30. The first of the three crosses on the reverse has been replaced by a quite clear '='. The specific gravity of this coin of 15·78 compares with M-H's SG 656 AV3a of 15·18. The coin was illustrated as lot 145 in Auction 8 of Credit Suisse mentioned above. *Khaleb AV3d* (J-J 19), though lighter than SG 589, the British Museum piece (1·4774 g compared with 1·603 g), has a comparable specific gravity (16·22 compared with 16·15). J-J 204 is another hitherto undescribed variant of the Khaleb AV3 group, for convenience called *Khaleb AV3i*. The obverse legend reads: **++AH88ΛCIΛƆVOI+**, the reverse: **++ΛIOƆOIЭNЭNΛOV+**. The diameter is 17 mm, the weight 1·6729 g. The specific gravity (16·00) is slightly lower than that of the AV3d, as is the gold

[5] F. Vaccaro, *Le Monete di Aksum* (Edizione a cura di *Italia Numismatica*, Casteldario, Mantova, 1967).

content (74·9 compared with 76·9). J-J 205 is an example of *Khaleb A/4*, the variety with a 'Γ' as the last letter of the obverse legend. It is marginally heavier than SG 592 (1·6554 g compared with 1·590 g); the specific gravity (15·04) is marginally higher also (SG 592 14·89), as is the gold content (65·8 compared with 64·2).

Allimiruis A/1 (J-J 198) is close to SG 660 and SG 661 (wt. 1·6060 g against 1·620 g and 1·607 g; SG 14·74 against 14·98 and 14·81).

Ellagabaz A/1 (J-J 199) weighs approximately the same (1·4970 g) as SG 593 and 662 (1·505 g and 1·467 g), but it has a low specific gravity (13·76), like SG 594 and 662 (13·88 and 13·50); SG 593 has the higher SG of 14·89. Though on stylistic grounds it is reasonable to assume that Ellagabaz is in the right place in the sequence of the kings, it does make the point that a rigid belief in constant debasement of the gold content of the coins with the passage of time may be dangerous.

J-J 6 and J-J 147, the two *Israel A/1* pieces, are from different sets of dies. They are identical with Anzani 229 and 245,[6] and the weights and SGs are very like those of M-H 202 (SG 664): wt. 1·5045 g and 1·4715 g compared with 1·515 g; SG 14·61 and 14·55 compared with 14·60.

J-J 201, the *Gersem A/2* piece, is close to SG 665 (wt. 1·2846 g compared with 1·228 g, SG 14·21 compared with 14·27). This confirms that this issue has a lower specific gravity than the gold coins of Joel, probably making Gersem's the last gold coin struck at Aksum, unless there are later coins now lost.

CONCLUSION

The study of Aksumite coins is bedevilled by the fact that hardly any two coins are from the same set of dies. This may be because comparatively few coins have survived, that is compared with Greek or contemporary Roman issues. It would be interesting to have data on more gold coins. One would expect that coins struck at the same time would have approximately the same gold content, and fuller data might shed further light on issues within a single reign.

[6] A. Anzani, 'Numismatica axumita', *RIN* 1926, pp. 5–110.