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Evaluation of 207 samples of the AIA (Anatolian Iron Age) project concerning pottery from Troy

publ.

[Peter Grave, Lisa Kealhofer, Pavol Hnila, Ben Marsh, Carolyn Aslan, Diane Thumm-Dograyan, Wendy Rigter, 2013]
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Mommsen, Internal Report, HISKP, Uni Bonn 05-05-2020

Part of the Anatolian Iron Age (AIA) project 2005-2009 concerned NAA measurements of elemental concentrations of samples from Troy spanning the periods from the LBA to the Hellenistic. This project has been described besides in the publication given above also in the web at:
https://opencontext.org/projects/45c12f7c-8744-47bb-902a-523d11ce0c32
with the list of samples including photos and a link to the csv file for download (https://opencontext.org/tables/036dbdc0-5ef6-4576-8421-f09ab0f8cec8.csv).
The data bank gives the concentrations of 199 pottery samples and 8 sediment/clay samples. The sample labels are
AIA 988 – 1130, 1778 – 1828, 2224 – 2228, and the clay samples 3918 - 3925. In the paper the location where the clay has been taken, is shown in Fig. 1.
Inspecting the data, the following samples with wrong separating characters are found presenting 2 values per column (repetition measurements?) destroying the data:
1078, 1784, 1785, 1786. Clay Sample 3918 has unexplainable values (e. g. 44 %, not ppm for Cr).

The NAA data have been measured at the Becquerel Lab's in Ontario, Canada.

The data bank gives the concentration values of 27 elements (the paper mentions 26):

As,Au,Ba,Br,Ca,Ce,Co,Cr,Cs,Eu,Fe,Hf,K,La,Lu,Na,Nd,Rb,Sb,Sc,Sm,Ta,Tb,Th,U,Yb,Zn

The missing element in the paper is probably Au or Br. I do not use both these elements and left them out. It is not specified in the paper, but probably all 26 elements are taken for the statistical evaluation and the forming of groups (wrong element choice, wrong groups see below). No experimental uncertainties are given, so a general 5% for all elements and samples is inserted into the bank. The raw data of the 208 samples are listed in Appendix 1. Inspecting these data, some apparently wrong values can be seen for a number of samples due probably to missing column separation marks and shifted values between columns in the csv file. The data of these samples have not yet be corrected.

The search for samples of similar composition pointing to a similar clay paste used in one or several neighbouring pottery workshops at a certain location and therefore to a common origin is done here with the Bonn filter procedure (Mommsen et al. 1988, Beier and

Mommsen 1994) considering experimental uncertainties and possible concentration variations (dilutions or enhancement) by the potter's recipes. The 19 elements

Ce, Cr, Cs, Eu, Fe, Hf, K, La, Lu, Nd, Rb, Sb, Sc, Sm, Tb, Th, U, Yb, K, Zn

have been used now. Not considered during the group formation are 6 elements. Co and Ta (and W, not measured) are known to scatter, if a tungsten carbide (WC) burr has been used for the drilling during the sample taking. Sometimes Co values above 100 ppm are encountered that point to this contamination or are a measurement or recording error. As and Na are known to vary in pieces made in the same workshop due to firing conditions (As) or to pottery making practices (Na), respectively. They are not used, since they are measurable with NAA with an uncertainty of only about 1% and would because of their large weight influence or even dominate the group forming, since the uncertainties are considered by the filtering procedure. Ba and Ca scatter also due to a possible contamination during storage in the ground or for Ca also due to possible pottery making practices. Since as mentioned, experimental uncertainties are considered in the statistical grouping calculations, elements measurable with NAA with low precision (like K, Nd, Rb, Sb, Tb, U, Zn) can be included, but, not knowing their experimental uncertainties, are allowed to vary in the formed groups up to 15 - 20%.

Besides the Troy dataset with labels AIA-No, additional sets with 236 samples from Sardis (Kealhofer et al. 2013):

https://opencontext.org/projects/cbd24bbb-c6fc-44ed-bd67-6f844f120ad5 with the list of samples including photos and a link to the csv file for download (https://opencontext.org/tables/e653f4f9-78a6-40c8-9d85-2a62bd4f48db.csv)

and 348 samples from Kinet Höyük (Grave et al. 2008):

https://opencontext.org/projects/81d1157d-28f4-46ff-98dd-94899c1688f8 with the list of samples including photos and a link to the csv file for download: (https://opencontext.org/tables/10a33c66-0bc1-40fb-b832-8f55aca970c5.csv).

are included in this evaluation. Labels Record are from the Sardis list, labels Sherd-No or Sample-No are from the Kinet Höyük list.

The following groups with 3 members or more have been formed here. We give the sample lists of the group members and the best relative fit factor of the sample with respect to its grouping values in brackets. Associated samples deviating in concentration values of 1 or 2 elements are given with a 'minus' and in most cases not members of the group, but singles. Altogether 84 chemical singles are found. There are no lists of members of the groups formed by Grave et al. 2008 given in this paper. It is conspicuous that often samples with continuous AIA numbers are found in a group or a pair pointing probably to a manual grouping by hand before the sample taking. For the large time period and with so many different types and forms many different groups are expected.

Sample groups of unknown origin:

Tr-1 3 samples
AIA 995(1.00), 997(1.00), 998(0.99)

Tr-2 3 samples
AIA 1794(0.88), 1798(0.88), 3925(1.37)
3925 is a clay sample (single in Grave publ.). The 7 other clay samples are here singles.

Tr-3 4 samples
AIA 1005(1.01), 1008(1.00), 1077(0.98), 1100(1.00)

Tr-4 2 (+ 1-) samples
AIA 1125(1.00), 1805(1.00)
AIA 1016 –

Tr-5 15 samples
AIA 1011(0.89), 1028(0.95), 1029(0.93), 1030(0.96), 1031(1.03, 1032(0.95), 1037(1.00), 1058(0.88), 1085(1.05), 1088(1.04), 1804(1.02), 1814(1.04), 1821(0.99), 1824(0.95), 1827(1.30),

Tr-6 3 samples
AIA 1006(0.99), 1026(1.05), 1828(0.96)

Tr-7 8 samples
AIA 990(0.98), 991(0.98), 993(0.98), 994(1.01), 999(0.99), 1000(1.05), 1002(1.00), 1003(0.99)

Tr-8 6 samples
AIA 1018(0.92), 1044(0.97), 1079(1.02), 1081(1.05), 1101(0.99), 1128(1.04)

Tr-9 4 samples
AIA 1012(0.90), 1014(1.33), 1105(0.88), 1107(0.96)

Tr11 3 samples
AIA 1060(1.03), 1062(0.97), 1063(0.99)

Tr12 3 samples
AIA 1051(1.01), 1053(0.98), 1117(1.01)

Tr13 5 samples
AIA 988(0.98), 1048(1.02), 1050(0.99), 1052(0.98), 1055(1.01)
probably close to Bonn group HellD with factor 1.00, Cr and Sm higher

pairs:

=003 AIA 1090, 1095
=004 AIA 1112, 1123
=005 AIA 1818, 1819
=006 AIA 1788, 1789
=007 AIA 1111, 1115
=018 AIA 1033, 1816

Groups with probably know origin by comparison with Bonn groups:

Since these NAA data are not mine and I do not know the quality, the comparison of concentration patterns with Bonn patterns might be wrong. The members of the groups have to be checked by archaeology, if the provenance assumption for each of them can be accepted or if single member sherds have to be removed from the group. The elements measurable with NAA with low precision (like K, Nd, Rb, Sb, Tb, U, Zn, see above) and not taken too seriously might have large variances pointing to probable subgroups that have to be separated from the main group and that might belong to another workshop at another location.

TrGB 20 samples, **Troy**

AIA 1010(0.97), 1015(1.02), 1023(0.99), 1024(0.93), 1039(0.94), 1096(1.03), 1106(0.93), 1779(1.16), 1795(1.12), 1796(1.04), 1797(1.00), 1800(0.93), 1801(0.94), 1803(0.98), 1810(0.97), 1811(1.11), 1812(0.98), 1813(0.96), 1815(1.05), 1823(0.90),

close to Bonn group TroB with factor 1.04, Yb and Lu lower

EuGA 12 (+1-) samples, **Euboea**

Record 923(0.84), 3754(0.98), Sherd 766(0.98), 802(1.14), 856(0.99), 1605(0.96), 1662(0.97), 1697(0.98),AIA 989(0.96), 1042(0.90), 1061(1.10), 1809(1.18),

close to Bonn group EuA (clay bed Phyllis near Lefkandi, Euboea) with factor 1.04, Lu and Yb lower, Cr higher

MiGD 6 samples, **Miletos**

Sherd 806(1.08), 1685(0.98), 1686(1.09), 1701(0.98), 1704(0.97), AIA 1049(0.89)

similar to Bonn group MilD (Miletus) with factor 0.98, Sm higher

SaGV 13 (+1-) samples, **Sardis?**

Record 941(0.88), 942(0.92), 943-(0.85), 944(0.92), 3711(0.91),AIA 1004(1.03), 1059(0.97), 1071(1.17), 1099(0.97), 1118(1.09), AIA 1119(1.04), 1822(1.01), 1825(1.31),

similar to Bonn group SarV (old name EphR, R), from Sardis, factor 1.14, Sm+?

Other samples:

Some samples are member of groups that have been formed in the other datasets from Kinet Höyük or Sardis. Most of these groups are still of unknown origin and have to be discussed with archaeologists.

An exception is a group Ki-1 with 2 samples from Sardis and 2 from Kinet Höyük and here sample AIA 1056. These sherds might have been made at the northeaster Peloponnese (group MYBE).

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