ANCIENT ANATOLIAN METALLURGY

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STAGES OF EARLY METALLURGY IN ANATOLIA

- Non-metallic period (prior to 8200 BC)
- Single metal period (after 8200 BC). Mainly native copper is shaped for simple tools and beads.
- Beginning of extractive metallurgy (after 5000 BC). Reduction of copper ores.
- Advanced metallurgy (after 4000 BC). Reduction of polymetallic ores, first alloys of copper, Appearance of silver.
- Industrial Period (after 2800 BC). Production of bronze followed by iron during the 1st millennium BC. Parting of gold.
EARLIEST COPPER AND COPPER ALLOYS

Chernykh, 1992
Aşılı Höyük: A Pre-pottery Neolithic settlement in Central Anatolia

Copper beads made from native copper.
ÇAYÖNÜ
CAN HASAN MACE HEAD

6000 - 5900 BC

Silver crystals

Yalçın 2000
Development Stage: Onset of Extractive Metallurgy (after ca. 5000 BC)

Tools from Mersin smelted copper (5000-4900 BC)

Yalcın 1999
Organization/Experimentation Stage: Advanced Metallurgy (After ca. 4000 BC)

- Utilization of polymetallic ores.
- First unintentional copper alloys that contain arsenic, when tenantite and energite ores are smelted.
- Production of silver by cupellation.
- Establishment of long distance metal trade: The Uruk trade network.
Metallurgy at Arslantepe and İkiztepe

Arsenical copper swords

İkiztepe ceremonial spearhead

<table>
<thead>
<tr>
<th>% Cu</th>
<th>% As</th>
<th>% Ni</th>
<th>% Zn</th>
<th>% Fe</th>
<th>% Sb</th>
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<tbody>
<tr>
<td>86.4</td>
<td>9.52</td>
<td>0.15</td>
<td>0.05</td>
<td>0.09</td>
<td>0.07</td>
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Use of Silver

Silver artifacts from Arslantepe royal tomb

Litharge from Fatmalı Kalecik

Fig. 8: Fatmalı-Kalecik, litharge No. TR 24/7. Inclusions of silver in lead oxide. Small black spots of silver chloride are scattered on the silver metal (gray). According to EDX measurements, the Ag concentrations in the lead oxide are slightly higher nearby these inclusions then in other parts of the litharge cake. Electron micrograph, BSE image. Length of image about 0.41 mm.

Table 6: Fatmalı-Kalecik, litharge No. TR 24/7. WDX micro-analyses of a silver inclusion in wt%. Abbreviation: n.d. = not detected.

<table>
<thead>
<tr>
<th></th>
<th>Ag</th>
<th>Pb</th>
<th>As</th>
<th>Au</th>
<th>Cu</th>
<th>total</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>95.0</td>
<td>6.4</td>
<td>n.d.</td>
<td>0.03</td>
<td>0.01</td>
<td>101.4</td>
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<tr>
<td>2</td>
<td>97.0</td>
<td>5.9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>0.04</td>
<td>103.0</td>
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<tr>
<td>3</td>
<td>88.9</td>
<td>9.4</td>
<td>0.14</td>
<td>n.d.</td>
<td>n.d.</td>
<td>98.4</td>
</tr>
<tr>
<td>4</td>
<td>90.1</td>
<td>7.9</td>
<td>0.52</td>
<td>0.04</td>
<td>n.d.</td>
<td>98.6</td>
</tr>
<tr>
<td>5</td>
<td>95.6</td>
<td>4.8</td>
<td>0.61</td>
<td>n.d.</td>
<td>0.08</td>
<td>101.1</td>
</tr>
<tr>
<td>6</td>
<td>96.5</td>
<td>5.9</td>
<td>n.d.</td>
<td>n.d.</td>
<td>0.08</td>
<td>102.4</td>
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</table>
Industrial Stage: Bronze and Iron Ages (after ca. 2800 BC)

- Earliest bronze objects appear in Anatolia
- Documentation of long distance metal trade
- Mass production of copper
- Earliest experimentation in production of iron and steel
- Full use of iron after ca. 1000 BC
- Parting of Gold
 Utilization of Bronze During Early Bronze Age

Percent bronze artifacts between 2700 - 2200 BC

Copper

Percent bronze artifacts Between 2200 - 1800 BC

Bronze

Figure 9 Percentages of copper-based artifacts containing more than 5 percent tin for Europe and the Near East, ca. 2700–2200 BC

Figure 10 Percentages of copper-based artifacts containing more than 5 percent tin for Europe and the Near East, ca. 2200–1800 BC
SITES THAT YIELDED BRONZE OBJECTS DURING THE 3rd. MILLENNIUM BC IN ANATOLIA
ALACAHÖYÜK EBA OBJECTS

Royal tombs
KESTEL GALERIES 2800-2200 BC

Fig. 15: Plan of Kestel mine. Lynn Willies
Entrance

Mining tools from the galleries.

Underground workings

Kestel Cassiterite
GÖLTEPE WORKSHOP

Göltepe grinding and crushing tools
Göltepe Materials

Figure 4. Tin X-ray map of the same area as in Figure 3.

Plate 9: Large storage vessel containing ground ore material, Pithouse 6, Göltepe, Early Bronze Age.
3rd MILLENIUM SITES WITH BRONZE

Map showing locations of 3rd millennium sites with bronze, including Troya, Kültepe, Arslantepe, Samsat, Tarsus, Mersin, Gedikli, Tell Judeidah, and Ur.
ASSYRIAN TRADERS AT KARUM

Acemhöyük Silver Workshop
Middle and Late Bronze Ages: The Hittite Empire
Mass Production of Copper

Uluburun Shipwreck (1350 BC)
Rows of ox hide copper ingots.

Tin ingots
EARLY IRON ARTIFACTS FROM ANATOLIA

Yalçın Ü., (1999)

Hittite Sword: Blade is steel, handle is bronze. Essen Ruhr Museum
HATTUSHILI III’S (1282-1250 BC) LETTER TO AN ASSYRIAN KING

….concerning the good iron which you mentioned in your letter, the store in Kizzuwatna has run out of good iron. I wrote you that it is not a suitable time to produce iron. They will produce iron but they have not finished yet. When they have finished, I will send it to you. Now I am sending you (sword/dagger) point……
Karagündüz Necrapole, Van.
11th and 10th Century BC.
SARDIS: The Capital
City of Lydians
PARTING GOLD