Roman Silver Objects from the Ancient Kingdom of Kartli (Caucasian Iberia) in Georgia (Mtskheta, Dedoplis Gora [Kareli district]) – a Lead Isotope Investigation

Teimuraz Parjanadze and Michael Bode

Keywords

Roman silver objects, Kingdom of Kartli, "Dedoplis Gora", Mtskheta, lead isotopes, provenance, Roman silver, Iranian silver

Abstract

Seven silver objects from antique Georgia, e. g. a raven and a goddess Diana sculpture, have been archaeometallurgically investigated. Six are dated into the 1st century AD and have been found in a burnt down palace at "Dedoplis Gora". They are all strongly affected by a fire which was caused by an earthquake in 80 AD. Another object of study is a fragmented silver box of the 3rd century AD, excavated at Mtskheta, the old capital of the Kingdom of Kartli. All objects come from a time of great political influence from Rome. The provenance investigation by lead isotope analysis points not only to three different sources in the Roman Empire, the Central Balkans, the Cévennes (Massif Central) in France and the Pangeon Mountains in northern Greece, but also to lead-silver mines in Iran.

Historical Introduction: Rome and the Kingdom of Kartli (Caucasian Iberia)

In antique historiography of the Near East and particularly the Caucasus, the character of Roman policy and influence is still an open topic of investigation. Here, with the Parthian state in the territory of modern Iran, Rome had to face another expanding civilization, which resulted in a long lasting political rivalry, in which the Kartlian Kingdom was drawn (overview: Gagoshidze, 2008; Lordkipanidze, 2001, pp.20-23). With this in mind, cultural-religious connections between Rome and Kartli must be examined closely.

In the first centuries of our era, Caucasian Iberia was a small but highly centralized state, which played an important role in the complex and lengthy formation process of the united Georgian nation. Rulers of Kartli of this period made a decisive political choice between Rome and the Parthians towards Rome. This is a period, when the Kingdom plays a strategic role in the foreign policy of Rome and became an ally in the Near East, which allowed controlling the most important commercial arteries and tactical positions. Holding the Caucasus passes, e. g. the Daryal pass, which was of greatest strategic significance according to Strabo (Lortkipanidze, 2010, pp.184-185), they protected the South Caucasus and Near East from northern nomadic tribes (Lomouri, 1975, p.13).

The Kingdom of Kartli in the 1st and 2nd century AD bordered the Roman provinces Pontus and Cappadocia. Active engagement in commercial relations was benefited by the closeness to the important trade route, the northern caravan road that crossed Transcaucasia. It had decisive significance for the local economic development (Lortkipanidze, 1968, p.68). Consequently, the capital of the Kingdom of Kartli, Mtskheta, was founded at the crossways of the major strategic roads, coming from all directions (Melikishvili, 1970, pp.510-537).

Commerce helped to integrate Caucasian Iberia into the economic system of the Mediterranean. With regard to that, since written sources in this period are few, the relation of Iberia-Colchis and Rome is mainly visible through imported wares, which can be found at diverse sites in Georgia (e. g. Chanishvili, 2008; Furtwängler et al., 2008; Gamkrelidze, 2012, p.194). It is noteworthy that the orientation of the Kingdom of Kartli from the very beginning was defined as the strife towards European civilization (Gamkrelidze, 2014, p.130).

Decorated hammered gold and silver objects, or *toreutic* material, of the first centuries of our era, exposed on the territory of Georgia, is especially significant since it provides information about political, cultural and economic life in Kartli in this important historical epoch. From ancient times objects made of silver were one of the main materials in ritual life and often played the role of diplomatic presents. Thus, typological, stylistic as well

Figure 1. Mtskheta, the capital of the Kingdom of Kartli (Caucasian Iberia), situated at the concourse of the rivers Mtkvari and Aragvi.

as technological study of *toreutics* from Georgia can enrich us with information about Kartli's diplomatic and religious-cultural contacts with the Roman Empire.

Numerous wares have been imported to Caucasian Iberia from the eastern Roman provinces like Egypt, Syria or Asia Minor via different trade routes. Gagoshidze (2008, pp.23-25) also mentions North Italian glass (*unguentaria*) which have been found in "Dedoplis Gora". With respect to the silver items of this study, it means that they could either have been made from nearby silver sources or even from silver sources of remote mines in the Roman World.

Provenance Studies of Roman Silver

As silver metal is mostly connected with lead ore mining all lead production centers throughout Roman Europe should be considered in first approximation as possible sources, even if lead ores are mentioned to be low in silver or silver-free (compare Tylecote, 1992, p.71 for deposits in *Flintshire* and *Derbyshire*).

These are those from Spain (Sierra Morena, Almería, Murcia) and Britain (Mendips, *Derbyshire*, *Flintshire*, etc.) with important mining remains, but also from the Central Balkans (Serbia, Kosovo), Germany (northern Rhenish Massif), Sardinia or France (Cévennes) which show traces of Roman activities of varying extent (compact overview: Arboledas Martínez, 2011; Davies, 1935; Meier, 1995; Nriagu, 1983; Rickard, 1932; Tylecote, 1992). Moreover, nearly 3000 Roman lead ingots can be attributed to these mines and prove their economic relevance (compare e.g. Bode, Hanel and Rothenhöfer, 2017; Bode, Hauptmann and Mezger, 2009; Domergue et al., 2016; Hanel, et al., 2013; Rico and Domergue, 2010; Rothenhöfer, Bode and Hanel, 2016).

The Greek silver mines of Lavrion certainly had no economic significance for the Roman supra-regional lead trade, but modest mining and smelting operations according to Strabo (Strabo 9.1.23) still took place in the Early Imperial to extract the silver from the metallurgical remains (see e. g. Kalcyk, 1982, p.245, Nriagu, 1983, p.140). Tylecote (1992, p.57) mentions a time frame of 600 to 25 BC for Greek workings at Lavrion. Likewise, the mines of the Pangeon and the Chalkidiki mountain ranges in the north of Greece may have also still been economically interesting for the Roman lead-silver business in the Early Imperial (see Davies, 1935, pp.233-235; Unger, 1987). Rio Tinto (Spain) in the extreme west of the Empire must be considered as well, being a site of significant production of copper and silver in antique times. Data of Republican and Imperial silver production slags and semi-reacted ores from Carto Lago in Rio Tinto will be part of the lead isotope study (data from Anguilano, 2012, pp.310-311).

Despite the importance of silver and lead, the number of major lead/silver ore districts in the Roman provinces was relatively small. They belong to separate geological sections and have different geneses which is why their isotopic signatures are indeed characteristic (Bode, 2016; Bode, Hanel and Rothenhöfer, 2015; Bode, Hauptmann and Mezger, 2009; Durali-Müller, 2005). With due care, there obviously also seem to be chronological dimensions to the mines visible through temporally differing climaxes of exploitation and lead export (summary: Rothenhöfer and Bode, 2012, pp.346-347).

With a view to the dating of the silver objects from "Dedoplis Gora" into the 1st century AD, all the above listed Roman ore deposits are potential silver sources. For the box from Mtskheta (3168-16, Table 1 and 2), dated into the 3rd century AD, one should perhaps favor the relatively nearby mining districts of the Balkans (compare Davies, 1935, pp.214-223; Meier, 1995, pp.91-99; Westner, 2017, pp.114-115), also because the supra-regional trade seems to have been less important at that time, implied by the paucity of lead ingot evidence (for Romano-Britain, see Gardiner, 2000).

This provenance study would be fragmentary without considering the relatively nearby ores in the territories of the ancient Parthian and Sasanian Empires (map of lead-silver-zinc mines in Momenzadeh, 2004, p.15). As Nriagu (1983, p.160) mentions, there is philological evidence that points to the Iranian region as an important producer of lead and silver for the ancient world (Strabo 15.2.4). Several thousand tons of slag from lead-silver ore smelting alone in the area of Nakhlak in the center of the Persian desert witness impressive silver production prehistorically, in the Parthian (Hallier, 1972, p.306) and especially in the Sasanian and Islamic period (Stöllner and Weisgerber, 2004; Wertime, 1968). Presumably, the

Figure 2. “Dedoplis Gora”, the hill, situated at the confluence of the Mtkvari and Ptsa rivers (Kareli municipality).

Figure 3. The shrine with the partly molten metal objects. Various artifacts of religious purpose. At the top left corner the statue of Diana – “Dedoplis Gora”, the antique palace, room number 20.

relative richness in silver made Nakhlak one of the most important mines in that region (Stöllner, 2004, p.51).

In diverse studies, lead isotope and trace element analyses have been combined (e. g. Gale, Genter and Wagner, 1980; Seeliger, et al., 1985; Wagner, et al., 1986). While “fingerprinting” with lead isotopes principally offers a straight connection between ore and metal, with trace elements, if at all, it is best possible with metal artifacts and metallurgical waste, e.g. metallic slag inclusions or metal remains from smelting places of the same period of time (compare e. g. Kiderlen, et al., 2016). In any case, mixing effects in both lead isotopy and trace element pattern must generally be considered.

Trace element comparison between silver and lead-silver ores is a very special case in archaeometallurgy: Silver metal gets its characteristic element pattern during cupellation of argentiferous lead metal. Pernicka and Bachmann (1983) could show experimentally that Ag, Au, Cu and Bi can indeed serve as provenance indicators in combination with lead isotope data. In our study case chemical data is presented (Table 2) but not considered due to lack of comparison material.

The “Roman” Silver Objects from the Kingdom of Kartli

The “Dedoplis Gora” is an archaeological monument located in the Kareli municipality (Figure 2). Here, the antique era palace, one of the residencies of the kings of Iberia was exposed. The palace was built in the 2nd century BC, but was ruined as a result of a powerful earthquake around 80 AD.

In 2013, in the process of excavations carried out at the palace, led by Iulon Gagoshidze, an intact sanctuary was found at area number 20, a chapel (Figure 3). On the upper surface of the altar, metal objects were partially fused together due to fire heat. This mass was removed and was brought to the Chemical Restoration Laboratory of the Archaeological Center of the Georgian National Museum. As a result of laboratory examination, treatment, restoration and conservation that lasted almost a year, the restored objects represent a whole complex of unique ritual artifacts of the 1st century AD. “Small statuettes of Greek deities (Apollo – Phoebus, Artemis – Diana, Leto – Latona, Tyche – Fortuna, and Silenus) and also silver and bronze statuettes of dolphin, eagle and raven were placed on the altar. Two eggs of Pheasant, silver thymiaterion (censer) and 13 denarii of the Emperor Augustus and 1 imitation of staters of Alexander the Great placed in the glass vessel were found here also. Such coincidence of Zoroastrism and Greco-Roman beliefs were very common for Iberia of Roman period.” (Gagoshidze, 2015, pp.124-125, 135-138 in Georgian, English abstract cited: pp.219-220).

The compilation of objects on the altar is a clear indicator that there was no sharp separation between the two cultures of the Roman and Parthian Empire at that time. Derived from this, it is easy to imagine that also trade relations with the Parthian Empire still existed.

From the exposed material the following artifacts were investigated:

- A statue of Artemis – Diana (Figure 4), height 11.5 cm, maximum width 3.0 cm, weight 239 g, with casted bronze statue clad in short tunic or *peplos*,

Figure 4. Figurine of the Roman goddess Diana. Sample spots are marked with red arrows.

Figure 5. Silver raven statue from “Dedoplis Gora”.

Figure 6. Silver rim from “Dedoplis Gora”.

Figure 7. Silver hanger from “Dedoplis Gora”.

head slightly turned rightwards, hair in a roller style with horn-like ends and with a knot on back of the head. There is a remnant of a corona; one lock lays on a shoulder, the face is damaged, a short nose can be discerned, eyeballs are given as puncture holes, short tunic / *peplos* with a belt on the waist, bare neck is adorned with a flat silver necklace, on the right hand and left shank there are silver fasteners as well as tetrahedral bracelet and shank bracelets, the right hand is raised upwards, the left hand is missing. On the shoulder it has a thick belt to keep an oval quiver on her back, the legs are crossed.

- A silver statue of a raven (Figure 5), height 9.0 cm, width 4.7 cm, weight 117 g. The statue is hollow, realistic, with a well modeled powerful head and beak, with longitudinal deepening on the beak for the nostrils, almond-form protruded eyes, covered with feathers with leaf-like rounded, coniferous ornamentation and legs with three claw spur feet.
- Band-like silver rim (Figure 6), diameter 9.0 cm, made in plates, folded in layers and with textile imprints.
- Fragment of a hanger (Figure 7), tetrahedral, cross section area 0.2 cm.

Figure 8. Fragments of a silver box in tomb 905, Mtskheta.

- A silver sculpture of the divinity Latona (Gagoshidze, 2015, p.135)
- A silver vessel (*thymiaterion*) (Gagoshidze, 2015, p.137).

Additionally, a silver box found in the Samtavro cemetery in Mtskheta (Figure 8), the old capital of the Kartlian Kingdom (Figure 1) was investigated. It was part of a sepulcher inventory belonging to a representative of nobility of the 3rd century AD (tomb - 905) (Apakidze and Nikolaishvili, 1994, pp.19-26, Figures 9-11, 1996). A similar object has never been found on the territory of Georgia in the archaeological sites of this period. Probably it functioned as a container for toiletries or cosmetics like for ceruse and rouge (piksad), widely used in antique world. The cist was exposed in 1985 in the south-eastern section of the Samtavro necropolis.

Description

Silver box / casket, length 20 cm, width 17.5 cm, height 9 cm; the object is broken into multiple pieces; it is rectangular and made of thin plates, probably originally overlaid on a wooden frame. From five sides (not at the bottom) it is decorated with figures: on the front side, at the head and end there are figures of two nude men standing: the left man has his hands spread while the left leg, bent in the knee, is put forward. On the spread hands and the shoulder, there is a snake encircling him. Both men seem to bend towards each other; they have garlands on their shoulders. On the remaining three sides there are feathers of a bird (eagle), while on the lid a Gorgon. In the middle section there is a remnant of a quadrangular lock, with silver pins (compare Apakidze and Nikolaishvili, 1996, p.11). The relief decoration is said to be probably of Eastern Mediterranean origin (see also Treister 2001, p.324).

Analytical Procedures

Pieces of silver have been clipped from the objects and cleaned in an ultra-sonic basin. Sample preparation and chemical analysis were conducted at the laboratory of the Deutsches Bergbau-Museum Bochum and the lead isotope analyses at the Goethe-Universität Frankfurt am Main in Germany.

For lead isotope and chemical analysis, 50 mg of partly corroded silver sample was dissolved in 5 ml distilled water and 3 ml concentrated nitric acid. For gold and tin quantification, ca. 10 mg was mixed with *aqua regia* in closed teflon beakers and heat was applied so both gold and tin could be extracted from the slowly precipitating silver chloride. Both solutions were then diluted with distilled water for a final concentration of 1000 mg/l. Main, minor and trace element quantification was done with a high resolution (HR) ICP-MS Element XR (Thermo Fisher Scientific, USA) with external calibration and checked with the silver standard RAgGP6 (Rand Refinery Ltd., South Africa). Stock solutions were diluted 1:100 for main and minor element and 1:10 for trace element determination with 5% nitric acid. For tin and gold, stock solutions were diluted to a tenth with 2% hydrochloric acid. Results were rounded according to analytical errors (see Table 2).

Lead isotope analyses were performed with a multi-collector ICP-MS Neptune (Thermo Fisher Scientific, USA) (see Table 1). Stock solutions were mixed with 2% nitric acid for a lead concentration of ca. 250 µg/kg and run together with a 100 µg/kg thallium isotope standard (National Institute of Standards & Technology (NIST) Standard Reference Material (SRM) 997, USA) to correct for mass bias. Instrumental drift was monitored using the NIST SRM 981 lead isotope standard (see Klein, et al., 2009 for instrumental procedure).

Provenance Deduced by Lead Isotope Analysis (LIA)

In Figures 9 and 10, diagrams with different LI ratios are shown. The supra-regional importance of the Roman lead mines presented in Figure 9 is attested by hundreds of lead ingots (see above). For a positive provenance result, object and ore data must match in all plots (a-d). Figure 9 shows that the LI system is particularly variable

Table 1. Lead isotope composition of the silver objects from Kareli and Mtskheta with 2-σ absolute standard deviation and deduced provenance from lead isotope comparison.

DBM	type	$^{206}Pb/^{204}Pb$	*2SD (abs)*	$^{207}Pb/^{204}Pb$	*2SD (abs)*	$^{208}Pb/^{204}Pb$	*2SD (abs)*	$^{207}Pb/^{206}Pb$	*2SD (abs)*	$^{208}Pb/^{206}Pb$	*2SD (abs)*	Suggested Provenance
3163-16	fragment of Diana's crown	18.726	*0.018*	15.690	*0.018*	38.934	*0.051*	0.8379	*0.0003*	2.0792	*0.0013*	Central Balkans
3164-16	fragment of Diana's foot	18.511	*0.035*	15.664	*0.031*	38.708	*0.085*	0.8461	*0.0004*	2.0911	*0.0014*	Mont Lozère/ Cévennes
3165-16	fragment of a silver raven	18.454	*0.024*	15.676	*0.030*	38.615	*0.091*	0.8495	*0.0004*	2.0924	*0.0020*	Mont Lozère/ Cévennes
3166-16	fragment of a silver helical plate	18.515	*0.012*	15.669	*0.011*	38.727	*0.028*	0.8463	*0.0002*	2.0916	*0.0005*	Mont Lozère/ Cévennes
3167-16	fragment of a silver hanger	18.522	*0.015*	15.653	*0.016*	38.656	*0.039*	0.8451	*0.0003*	2.0870	*0.0009*	Nakhlak/Iran
3168-16	fragment of silver box	18.704	*0.031*	15.667	*0.029*	38.796	*0.072*	0.8377	*0.0003*	2.0743	*0.0013*	Pangeon Mt./N-Greece
4514-16	sculpture of the divinity Latona	18.527	*0.005*	15.657	*0.005*	38.701	*0.015*	0.8451	*0.0001*	2.0888	*0.0004*	Nakhlak/Iran
4520-16	vessel (thymiaterion)	18.525	*0.004*	15.657	*0.005*	38.706	*0.016*	0.8452	*0.0001*	2.0894	*0.0004*	Nakhlak/Iran

Table 2. Chemical composition of the silver objects from Kareli and Mtskheta (data in µg/g, if not in %, Co < 0.5 µg/g in all samples). Loss in sum due to the formation of AgCl in the burial environment.

DBM	type	Ag [%]	Au [%]	Pb [%]	Cu [%]	Total [%]	Sn	Sb	Te	Bi	P	S	Fe	Ni	Zn	As	Se
3163-16	fragment of Diana's crown	91	0.77	2.17	0.56	95	2900	45	100	100	25	130	170	20	80	20	<10
3164-16	fragment of Diana's foot	79	0.60	7.78	2.16	90	9800	40	90	330	30	90	120	15	70	15	130
3165-16	fragment of a silver raven	86	0.53	0.34	2.41	89	60	6	80	690	45	4100	75	9	260	8	<10
3166-16	fragment of a silver helical plate	86	0.71	0.33	0.62	88	50	8	80	370	65	140	75	10	30	7	<10
3167-16	fragment of a silver hanger	93	1.16	0.79	1.01	96	160	8	90	820	30	190	30	10	45	7	55
3168-16	fragment of silver box	52	0.48	0.64	1.09	54	40	7	45	75	510	2100	1000	10	10	8	65
4514-16	sculpture of the divinity Latona	89	0.42	0.23	2.23	92	1100	100	75	190	80	800	760	7	130	20	20
4520-16	vessel (thymiaterion)	93	1.19	1.40	2.81	98	140	75	35	640	15	80	55	11	65	20	15

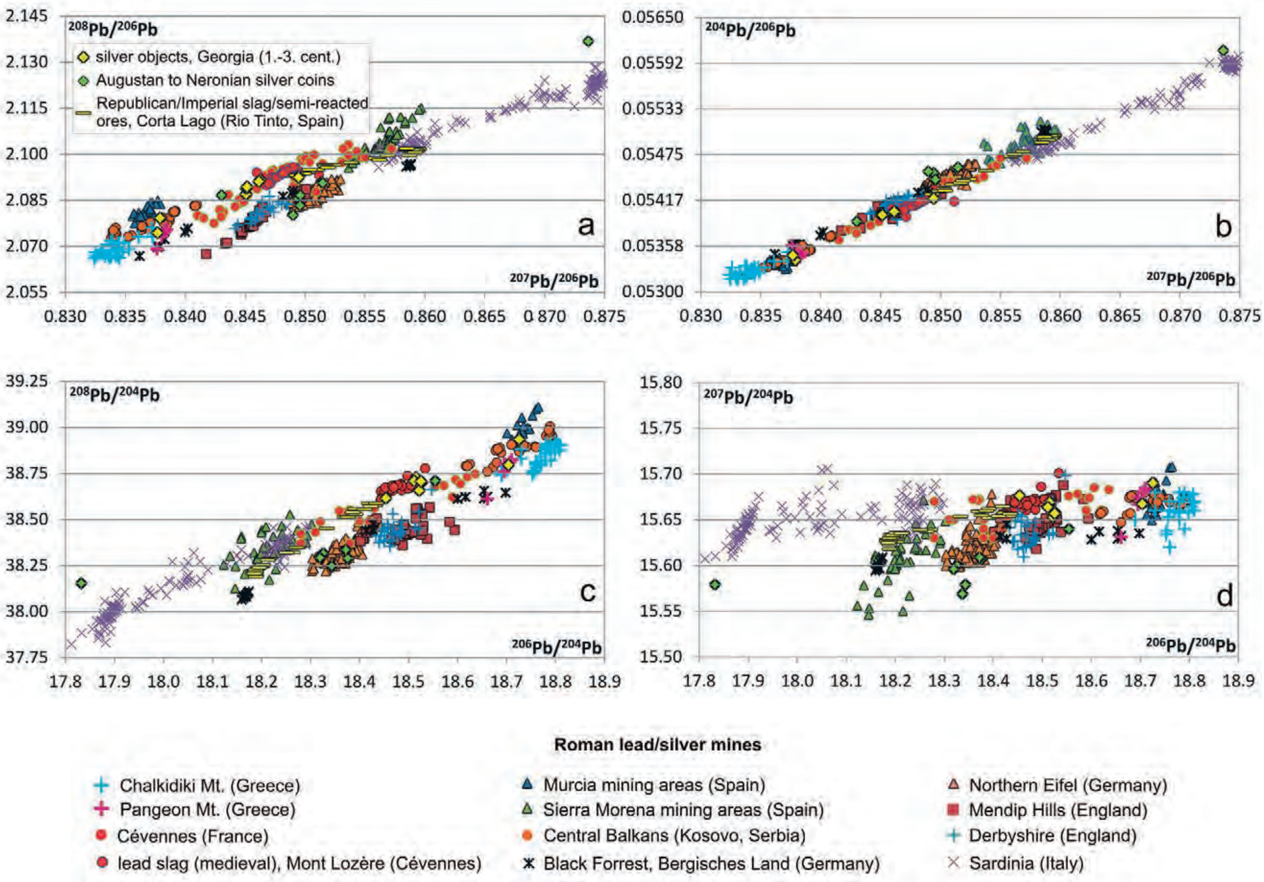

Figure 9a-d. Lead isotope diagrams comparing the Georgian silver samples, Augustan to Neronian silver coins (Butcher and Ponting, 2005), medieval lead slags from Mont Lozère (Cévennes) (Baron, et al., 2006) and lead ores from Great Britain (Rohl, 1996), France (Baron, et al., 2006; Brévart, Dupré and Allègre, 1982), Germany (Bielicki and Tischendorf, 1991; Bode, Hauptmann and Mezger, 2009; Durali-Müller, 2005; Krahn and Baumann, 1996; Large, Schaeffer and Höhndorf, 1983; Schneider and Haack, 1996), Greece (Chalkias et al., 1988; Gale, Picard and Barrandon, 1988; Stos-Gale, 1992; Vavelidis et al., 1985; Wagner et al., 1986), the Kosovo (Pernicka, et al., 1993, Veselinovíc-Williams, 2011, Westner, 2017), Sardinia (Boni and Köppel, 1985; Dayton and Dayton, 1986; Ludwig, et al., 1989; Stos-Gale, et al., 1995), Serbia (Pernicka, et al., 1993) and Spain (Anguilano, 2012[also with data from slag material]; Arribas and Tosdal, 1994; Dayton and Dayton, 1986; Graeser and Friedrich, 1970; Santos Zalduegui, et al., 2004; Tornos and Chiaradia, 2004; Trincherini, et al., 2001 and unpublished data).

and the Roman mines are in principle separate from each other, if display options like plots a-d are considered. Not only the geological age, but also the local geochemical environment influences the LI composition in an ore body. As ^{204}Pb is the least abundant isotope of naturally occurring lead, resulting in low signal intensities in a detection system of a mass spectrometer, data normalized to ^{204}Pb (9c and d) have greater analytical errors. This is why there is a need to use also the plots to ^{206}Pb.

Potential Roman and Iranian Mines

In Figure 9, two silver samples (3163-16, 3168-16, Table 1), a fragment of Diana's crown (1st century) and a fragment from the Mtskheta box (3rd century), coincide with lead (silver) ores of the Kopaonik mountain range (Kosovo, Serbia), but also with ore data from the Pangeon Mountains in northern Greece. Data sets from Murcia (Spain), the Black Forrest (Germany) or the Chalkidiki region (Greece) with similar isotopic pattern in contrast allow the exclusion of these mines from the provenance search. Lavrion ores are significantly offside and not shown. With a larger scale (Figure 10) it is possible to make a further differentiation: Plots a and c allow to assign sample 3163-16 (Diana's crown) to the Central Balkans and sample 3168-16 (silver box fragment) to the mines of the Pangeon Mountains. So, for the box, not only the decoration but also the silver is supposed to be of Eastern Mediterranean origin (see above). Siphnos lead ores (not shown) partly match, too, but there are so far no signs of Roman mining visible on the island (Matthäus, 1985, p.51, cited in Meier, 1995).

For the remaining 6 silver samples, Figure 9, focusing on the Roman controlled deposits, clearly shows that apart from the ore fields of the Cévennes (Massif Central) in southeast France, all other significant Roman mining districts can be sorted out as potential sil-

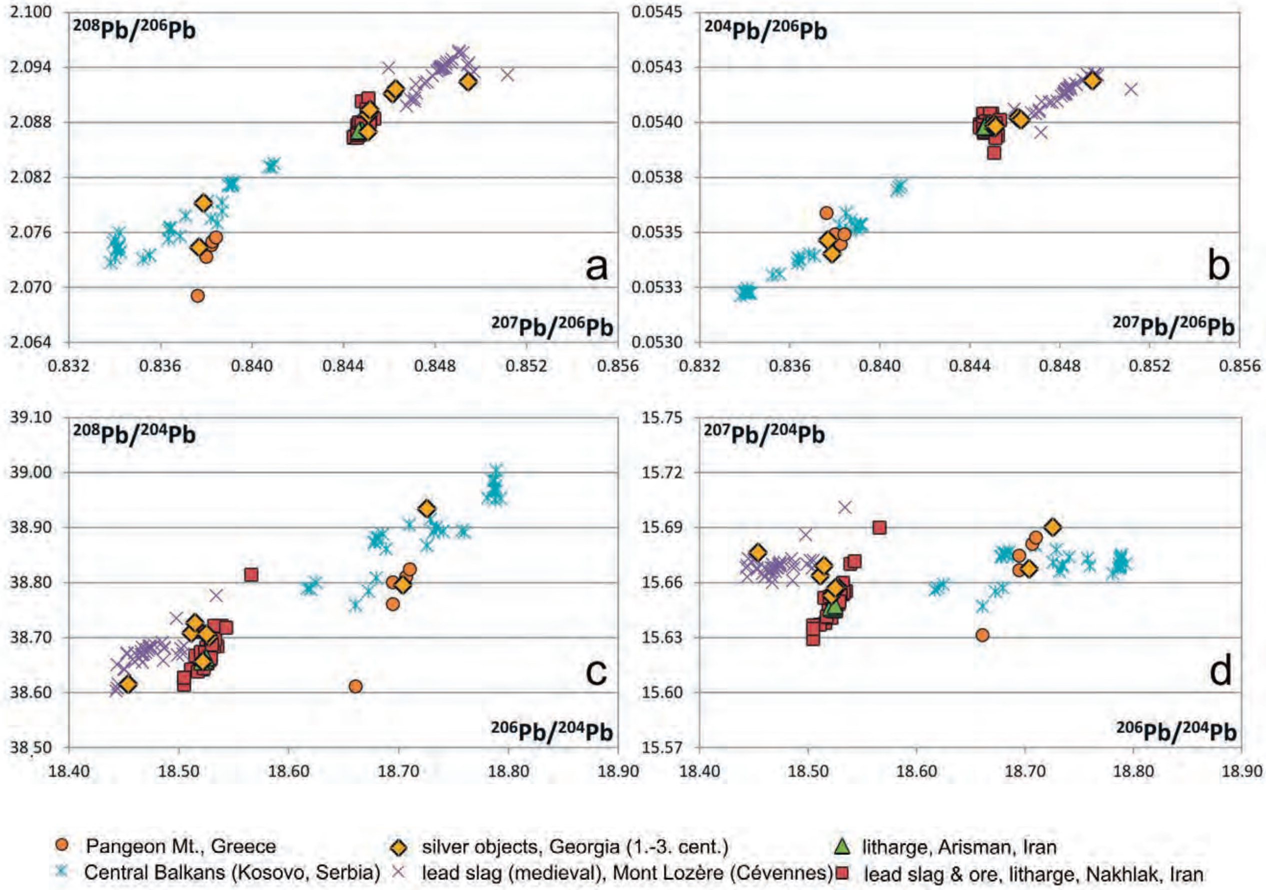

Figure 10a-d. Lead isotope diagrams comparing the Georgian silver samples with lead ore and slag and litharge from Nakhlak (Iran) (Mirnejad, Simonetti and Molasaheli, 2015; Pernicka et al., 2011; Stos-Gale, 2001), litharge from Arisman (Iran) (Pernicka et al., 2011) as well as with medieval lead slag from Mont Lozère (Cévennes) (Baron et al., 2006), lead ore from the Pangeon Mountains (Greece) (Stos-Gale, 1992, OXALID) and lead ore data from the Central Balkans (Pernicka, et al., 1993, Veselinovíc-Williams, 2011, Westner, 2017).

ver suppliers. And again, Figure 10 gives a more precise picture. With the addition of lead ores and slags as well as litharge from Nakhlak and nearby Arisman in Iran, the silver samples on the basis of plots a to d can be further divided into two groups: Samples 3167-16 (hanger), 4514-16 (sculpture of Latona) and 4520-16 (vessel) are compatible with the isotope field of the silver mines in Iran and samples 3164-16 (Diana's foot), 3165-16 (raven) and 3166-16 (plate) are fully consistent with the range of those published for the medieval lead slags from the Mont Lozère Massif in France. The origin of the silver of the hanger, the vessel, and especially the Romano-Greek Latona sculpture from outside the Romans' sphere could speak for that these objects have been manufactured in Georgia and therefore have not been a diplomatic gift from Rome.

Although the lead slags from Mont Lozère are medieval, according to Ploquin et al. (2003, pp.641-642), who did pollen and peat sample studies at Narses Mortes on the south-western edge of Mont Lozère, in the mines, lead smelting took place also during the antique period ('Latenian level, may be continued in Galloroman time') (see also Baron, Le Carlier and Ploquin, 2010, p.154). Further indication for Roman lead (silver) mining / smelting activities in south-eastern France was recorded in sediment cores from Lake Anterne (Haute-Savoie) in the western Alps, showing a lead peak at 200 AD (Arnaud, et al., 2010). The mineralization at Mont Lozère is characterized by Pb-Ag ores (Baron, 2006, p.242).

And more Roman objects seem to be of metal from the Cévennes lead-zinc ores: lead ingots from a shipwreck near Rena Maiore (Sardinia), brass ingots from Corse and leaded bronzes from Narbonne (France) (see Hanel and Bode, 2016, pp.172-174).

That the two sampled parts of the Diana figurine contain lead from different sources is (see Figure 4) also shown in the chemical compositions (Table 2). This could have a number of explanations: it may have been originally produced that way, meaning that the goddess was made most likely in Georgia or the pieces may not have belonged together, representing antique repairs. In general, the gold contents of all the Georgian objects sampled range from 0.4 to 1.2 percent, which is within the normal range of Roman, Parthian and Sassanian silver (Butcher and Ponting, 2005; Caley, 1950; Gordus, 1972; Hughes and Hall, 1979), the reason behind the relatively high gold contents of silver from this period is however unclear and may represent gold impurities in silver ore or in some cases recycled silver with traces of gilding.

The data set was also compared with silver coins minted between the reigns of Augustus and Nero analyzed by Butcher and Ponting (Figure 9) (2005, pp.191-194, Table 3). Instead of arguing that the provenance of five of the silver coins could be produced with silver from Britain or the Erzgebirge region (Germany), it seems more plausible to favor instead deposits in the Rhenish Massif (e. g. the northern Eifel) (Figure 9, green diamonds), as here there was Roman lead (silver) ore mining during the early Imperial Roman period with export of lead recorded by ca. 150 ingots (Bode, 2013; Rothenhöfer, 2013). And to relate a denarius of Tiberius (WM160) to ores in India seems also rather unlikely, if nearby ores from Sardinia (Iglesiente-Sulcis) show a relatively good correlation to that data point in diagrams 9 a-d, considering the error. Finally, it is necessary to address the Augustan coin WM34, which, unlike Butcher and Ponting who attribute it to Rio Tinto in Spain, could instead be better connected to the lead (silver) ores in the Cévennes, especially, if it was struck at Lyon on the northern edge of the Massif Central.

Conclusions

The investigation shows that together with archaeological information from the mines the lead isotope system becomes a powerful tool for provenance studies. That in this case the combination of mining archaeology and lead isotope comparison gives a clear picture about the silver origins make mixing effects in the Georgian silver samples rather unlikely. With the Cévennes, and here most likely with the mines at Mont Lozère, the Central Balkans, the Pangeon Mountains in northern Greece and finally the silver mines of Nakhlak four different silver sources have clearly stood out and show the complexity of trade in Roman times.

Considering the metal composition of the two figurines of the deities Diana and Latona, they seem to be made by local artists. It could mean that the Romano-Greek goddess and gods no more have been part of an imported but already of a completely accepted religion, speaking for a very close - not only commercial but also spiritual - relationship between Rome and ancient Georgia at that period of time. Nevertheless, Zoroastrianism still played an important role as well as trade with the adjacent Parthians.

This study also like some previous publications points out that the Massif Central should be seen as a significant production center for the metal supply during the Early Imperial. This does not just apply to silver and lead, but also to other raw materials such as calamine (Hanel and Bode, 2016; Rothenhöfer et al., 2017).

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Authors

Teimuraz Parjanadze
Georgian National Museum,
Restauration – Conservation Scientific Institute
3, Rustaveli Avenue, 0105, Tbilisi, Georgia
temo.parjanadze@yahoo.com

Michael Bode (Corresponding Author)
Deutsches Bergbau-Museum Bochum,
Research Department,
Herner Str. 45, 44787 Bochum, Germany
michael.bode@bergbaumuseum.de