Phasis 17, 2014

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# Ancient Metal Production Sites from Southwest Georgia in Light of New Archeological Evidence

**Introduction**

There has long been a tradition of very early ironworking in south-eastern Black Sea coastal region, south of the Caucasus range of mountains, and north of the mountainous region of north-eastern Anatolia. This can be gauged from Greek and Roman written sources (such as Herodotus, Xenophon and Strabon) which suggest that this south-eastern Black Sea coastal zone had, by the 5$^{th}$ century BC, gained the reputation as being the region where ironworking originated. According to one biblical tradition an ancient Georgian tribe, the Tubal (or Tabal) are said to be founders of metallurgy and the art of blacksmithing (Kuparadze 2008).

However it is also clear that this region was also a known source of some of the other main metals of antiquity, particularly copper and gold. The antiquity of the tradition for early gold working here can be gauged by the description in the Odyssey in which Jason and his fellow Argonauts sailed up the River Phasis – now the River Rioni with Poti (the early Greek colony of Phasis) at its mouth – before they found, stole and fled with the 'golden fleece'.


Fig. 1: Location map showing the extent of modern Georgia as it was in 1920, the western half of which approximates to ancient Colchis, the eastern half of which was known as Iberia

**Discovery and Exploration of Prehistoric Smelting Sites in Western Georgia**

Sometime after the Second World War prehistoric smelting sites – initially all identified as belonging to ironworking – began to be noticed made in the hilly coastal region of western Georgia, the region known to the ancient Greeks as Colchis. A large scale field survey project was subsequently initiated in 1960 by IA Gzelishvili (Gzelishvili 1964), but mainly carried out between 1970 and 1984 by Professor David Khakhutaishvili. During this survey approximately 400 prehistoric smelting sites scattered across the coastal region of western Georgia were noted, and a few sites from each area investigated, were excavated to examine the layout and form of the furnaces and associated features, and also with the aim of recovering material suitable for dating.

These were thought at the time to represent some of the earliest and most widespread prehistoric iron smelting remains yet discovered. An interim report on the broad scale and scope of this survey project as well as the excavation of 26 of these sites was published as 'The Manufacture of Iron in Ancient Colchis' (in Russian) in 1987 (Khakhutaishvili 1987), translated into English in 2009 (Khakhutaishvili 2009). Radiocarbon and archaeo-magnetic dates indicated that most of these sites were operating between 1000 and 600 BC, at least as old as the oldest known iron smelting sites in the Mediterranean. Importantly, however, one region – the Supsa-Gubazeuli river system – yielded a series of dates from 1800 BC to 600 BC for the smelting operations being carried out there.

This early field survey was the first project of its kind in this region to set out to record and investigate the traces of a type of prehistoric smelting site which had begun to be noticed as archaeologically significant features in the landscape – in this case the hilly areas between the various river valleys which emptied into the Black Sea – since the end of the Second World War. The great majority of the 400 or so prehistoric smelting sites are likely to have been found as a result of the expansion or reorganisation of the Soviet collective farm system, with this type of terrain being used extensively for tea plantations in western Georgia.

The early survey focussed on four areas – each approximately 5-10 km square – where prehistoric smelting sites were found to be common, the areas being centred on four particular river systems in this coastal part of western Georgia. Listed from south to north these are the Chorokhi, the Choloki-Ochkhamuri, the Supsa-Gubazeuli, and the Khobi-Ochkhomuri river systems (Fig. 2). In Khakhutaishvili's report (2009 [1987]) it was also noted that a further fifth area of sites was thought to exist in the Black Sea coastal region to the west of Trebizond (the port of Trabzon, in what is now north-east Turkey) in the vicinity of which the ancient group of people the Chalybes/Khalybs, whose name he suggests may have meant 'the makers of good iron' (ie steel) may have originated.

In addition to the smelting sites noted earlier, a new group of sites was much more recently identified during fieldwork (by one of the present researchers) in the Chakvistskali river valley, north-east of Batumi (Khakhutaishvili and Tavamaishvili 2002). More recent (but as yet unpublished) work on these would, broadly speaking, suggest two phases of activity, one involving copper smelting in the second half of the second millennium BC, and another involving iron smelting early in the 1$^{st}$ millennium BC (personal communication from A Hauptmann and N Khakhutaishvili).

Having discovered the existence of this early smelting industry the principal first aim of this early field project were to undertake a large scale preliminary exploratory survey investigate the scale, extent, identity, survival and date of the industry. The damage to these early industrial remains caused by erosion – by the cultivation of the land largely for tea plantations – was also recognised in the interim report. Despite the substantial amount of work carried out over the last 50 years by Georgian archaeologists, a number of key questions remain, especially those relating to the technology, chronology, and spatial distribution of the industry.

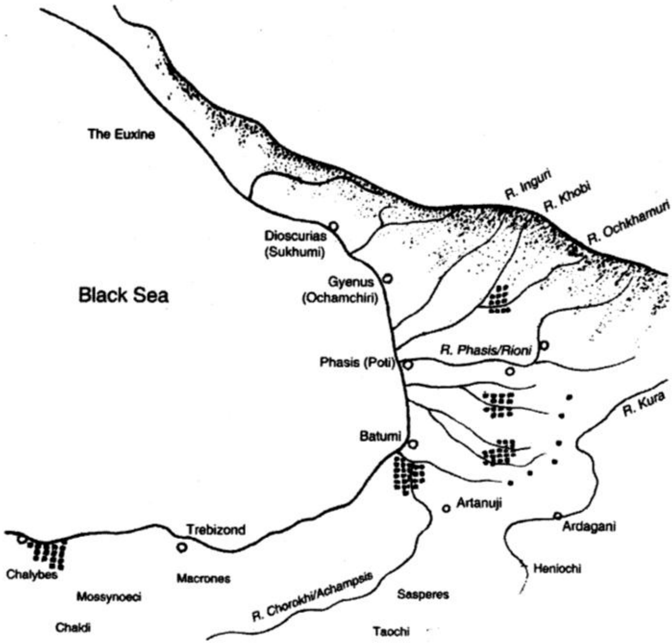



Fig. 2: Location map of known/suspected prehistoric smelting sites in western Georgia and north eastern Turkey (Khakhutaishvili 2009 [1987], 20).

But accurately mapping the widespread scattering of sites that were discovered was still a big problem as although accurate maps (closely equivalent to British Ordnance Survey maps) at different scales did exist at the time of this work their use was restricted to the Soviet Military authorities. Also global positioning (satellite) system (GPS) technology was not then available as an alternative, so the positions of the sites were simply noted by reference to existing local topographical detail, not all of which still survives. The only other possible source of information as to the location of many of the sites noted was the (fading) memory of those people involved with the investigations of particular localities at the time.

Background to the New Landscape Field Project and the First Two Fieldwork Seasons of October 2010 and July 2012.

Unfortunately while the Soviet state still existed this early Georgian archaeological field research remained almost completely unknown to the wider world of archaeological scholarly research, partly because of restrictions placed on the flow of information from this region, and partly because the interim report on this work was published in Russian (Khakhutaishvili 1987). This report published the excavations of 26 sites subjected to more intensive examination. Information on the whereabouts of the rest of the 400 or so sites observed survived only as topographical descriptions and sketches in the original field note books kept at the time of the survey.

After the collapse of the Soviet system in Georgia in 1991 the recognition of this early preliminary survey work, and the possibility of developing it before the knowledge of the whereabouts of the sites, or the sites themselves, became lost, only became possible with the subsequent development of archaeological research work in western Georgia. This has been led by the re-establishment of the Pichvnari archaeological project by Professors Michael Vickers (Oxford University, UK) and Amiran Kakhidze (Batumi Archaeological Museum, and Rutveli State University, Batumi, Georgia), Pichvnari having been the site of intermittent, settlement from the mid to late 2nd millennium BC to the Hellenistic period of the later first millennium BC (Mikeladze and Khakhutaishvili 1985).

The 2009 republication in English of David Khakhutaishvili's interim report of his 25 year exploratory campaign of field work also included an appraisal both of what had been achieved and to gauge the full potential the work, as well as assessing what remained to be done if that was to be achieved. This assessment revealed that, although very extensive exploratory work had been undertaken, urgent work was now needed not only to progress the research in a systematic way, but also that many of the sites would need relocating and mapping, then examining (in a few cases re-examining) using the most up-to-date archaeological research techniques, before all knowledge of even their whereabouts was lost.

Although a programme of dating was carried out earlier on some of the furnace and related remains many questions relating to dating still remain, as does the stratigraphical and hence chronological development of individual sites, some of which may be multi-period. Modern dating techniques such as accelerator radiocarbon determination and optically stimulated luminescence (OSL) should allow a much clearer dating picture to emerge. It was also clear that modem archaeological survey techniques – for land survey as well as geophysical prospection – would greatly aid the pin-pointing of individual sites and the planning of systematic archaeological investigation. Some chemical and microstructural analyses of slags were conducted by Georgian specialists as part of this earlier program of investigation, and these reports concluded that the smelting remains are that of iron production (Inanishvili 2007; Tavadze *et al.* 1984)

Unfortunately, most of the chemical analysis do not report copper and zinc contents, and the few published photomicrographs are difficult to interpret. It is possible that some of the earliest smelting remains found were indeed those relating to the manufacture of iron and that this led to the assumption that all the sites found related to the manufacture of iron although (as our present survey has shown) this clearly was not the case and many of the smelting sites across the region related to early copper making although the slags (and presumably the ores) were also rich in iron (Erb-Satullo et al., 2014). This may have caused the confusion. A follow-up analytical programme on the smelting related debris on the sites seems to have been planned but unfortunately (mainly) not carried out as this should have shown the full scope of the prehistoric smelting industries across this eastern Black Sea region in the Colchian period.

Research work from elsewhere in the eastern Mediterranean region has suggested that, although smelted iron sometimes occurs in archaeological contexts before or during the mid 2$^{nd}$ millennium BC, it doesn't seem to occur on anything like a larger scale before the late 2$^{nd}$ millennium BC or later (Waldbaum 1999). Thus while there was no particular reason to doubt the overall dating results from the early survey work in western Georgia, the very early dates (see above) for a series of sites in Guria (in the area north-east of Ozurgeti, and south of the Supsa River) were surprising, at least for a series of iron smelting furnaces. However in the (1987) publication the likelihood that iron smelting in this region actually developed from copper smelting was suggested, but no definitive analytical research was carried to see if there was a link between this possibility and the actual smelting debris from the sites excavated here.

In this way the results of the early survey work not only demonstrated that the industry was very widespread along the hilly inland part of the

Black Sea coastal region of western Georgia, but also that it appeared to have been active, in the Supsa-Gubazeuli region at least, between about the mid second millennium and the mid first millennium BC. This is just the period when a transitional copper to iron smelting industry might be expected to be operating and developing. For this reason the main cluster of smelting sites reported in the area of the Supsa-Gubazeuli river zone was selected for the initial pilot season of exploratory fieldwork in the autumn of 2010, to be carried out by a join UK (University of Oxford, Research Laboratory for Archaeology and the History of Art) and Georgian (Batumi University and Archaeological Museum) team, and was made possible by a British Academy 'small' grant.

The new joint Georgian-British field project to examine this still little known but unusually extensive industry – at least in its survival from ancient times – was begun in September 2010.

Its main aim is to build on the earlier pioneering archaeological survey work carried out across western Georgia, and to test and develop methods of locating, exploring and investigating the potentially large database of sites using a systematic combination of field survey techniques, limited 'pin-point' excavation, scientific identification and dating. Leading on from this the overall objective is to examine the evidence for the revolutionary transitional phase in the late Bronze Age when the manufacture and exploitation of iron developed into a large industry but a transition for which the field evidence is largely lacking.

The first field season was based in Guria with the overall aim of locating, mapping, examining recovering identifiable field evidence from the industry in the Supsa-Gubazeuli region where the earliest dates were previously obtained (Fig. 3). As elsewhere in Western Georgia only a small proportion of the sites were previously examined in any kind of detail and an analytical appraisal of the more detailed nature and development of the industry had also been left for future work. The intention was also to look at how we might identify and explore the exploitation of the landscape and its development for this prehistoric industry. During this initial exploratory field season some 27 sites were found and mapped, and although most of these were sites observed in the original survey, some new sites were also noted.

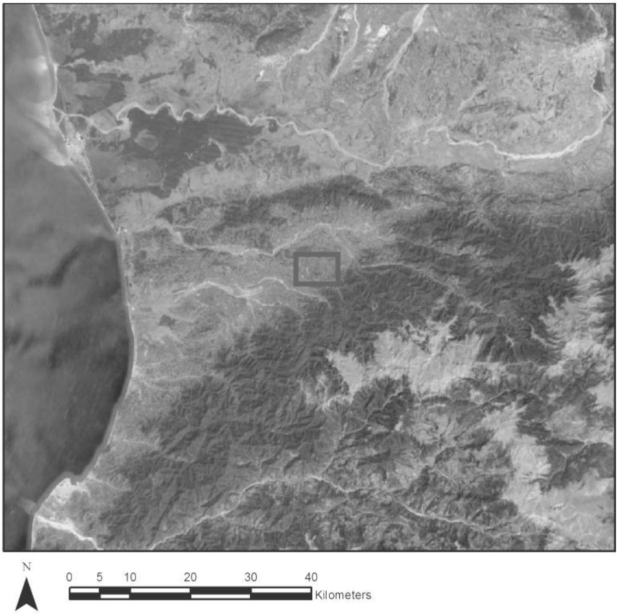



Fig. 3: Google earth view of the Guria region of western Georgia with the 2010 and 2012 field survey area outlined in red here and lying just south of the Supsa River.Note the position of the survey area in an intermediate zone between the Colchian lowands and the Rioni river basin to the north, and the more mountainous regions of the Lesser Caucasus to the south.

In the summer of 2012 a second season of exploratory field survey work was carried out in this same Guria area with the aim of finishing the work started in 2010, and thus to enable a much more complete synthesis and evaluation of the surviving prehistoric smelting industry of this area to be made. A further 20 sites were located, thus giving about 50 sites in all for the Supsa River region – more or less the same overall number as in the original survey (Fig. 4). Most of the sites lay inside a 5 km square area within the districts of the modern villages of Mziani, Askana, with some situated in the adjacent village districts of Mishvidaubari and Nagomari. However not all the original sites were located and this was balanced by the discovery of about 10 new ones. This second season of investigative work in Guria was made possible by an exploratory grant from National Geographic.

**2010 and 2012 Guria Field Survey Results**

Those areas where the smelting sites had been located lay inland – from the generally (still marshy) low lying area in the central part of the Georgian Black Sea coast – in the hilly zone between the various rivers which flowed westwards into the sea. It has previously been pointed out that the sub-soil of these hill consisted of lateritic deposits overlain by yellow clay (of diluvial or flood origin), relatively rich in magnetite grains which gradually get washed into the rivers and ultimately find their way to the shore of the Black Sea, this coast of which has long been known for its magnetite-rich sandy deposits. The main concentration of sites had been noted in the middle region of the Supsa River, mainly in or near the valley of its main tributary, the Gubazeuli River (Khakhutaishvili 2009 [1987], 53).

Little or no trace was still visible of most of the Guria smelting sites although it proved possible to locate many of them using a combination of the original notes as to their whereabouts together with local knowledge where this still existed. Thus our first task was to use the original notes as to the location of the sites and plot the approximate positions of the sites on the relevant part of a copy of one of the old (1:50,000) military maps before we set out to look for them.

To allow the best use of survey time the base for the project was established at Mziani, near the centre of the five km square area (see Fig. 4) where, from the sketch maps accompanying the description of this area in the 1987 publication summarising the work here, nearly all the reputed sites were thought to cluster. The first survey priority then was to list, identify and plot the approximate position of as many as possible of all smelting sites previously noted in the study area but not so far recorded on any map. As far as possible this was done by close examination of the original field notes (compiled when sites in the Supsa-Gubazeuli region of western Georgia were first investigated during the 1970's and early 1980's) together with what local knowledge was still available. The approximate positions of the 50 smelting sites which had been observed previously were thus plotted, the next task being to start to hunt for them on the ground so that they could be plotted more accurately (by GPS and marked on a 1:25,000 specially prepared base map adapted from the relevant 1:50,000 soviet military map of this area).

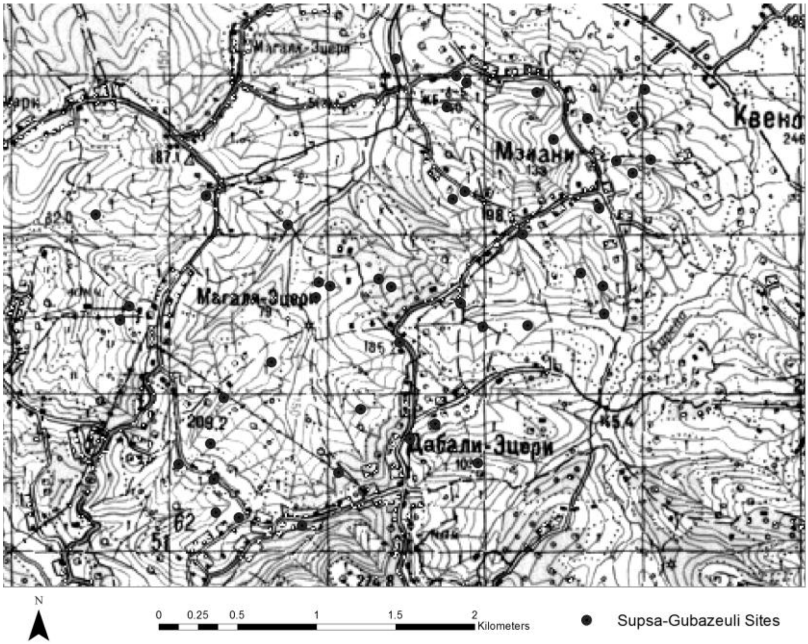



Fig. 4: Larger scale view of the 2010/2012 Survey area overlaid onto the 1:50,000 Soviet military map of this area (enlarged to 1:25,000 for ease of use during the survey)

It soon became clear that the vast majority if not all the sites previously noted lay in the (quite large) areas exploited for tea plantations – or smaller scale agricultural operations (such as hazelnut growing) – during the era of the Soviet collective farm system which had been imposed on quite a large proportion of the landscape in this region by the late 1950's. Additional exploration was also carried out in areas (mainly woodland) to begin to assess the potential for the discovery of previously unknown metal smelting or related sites. Some sites which were suspected (from previous work) from previous observations were now difficult to locate but in some of these cases they were found by using a magnetic susceptibility probe in a 'free-form' exploratory mode. Prehistoric sites like these are now often invisible, hidden beneath modern landscape features, agriculture, woodland and so on. The potential for locating industrial and habitation sites by measuring the magnetic component of the topsoil tends to be overlooked by archaeologists, but is particularly effective in the case of smelting sites.

In these areas south of the Supsa River the very overgrown nature of the old tea plantations occupying much of this landscape meant that this approach had to be applied in a more targeted way to areas where geophysics was more feasible (that is where the ground was less overgrown) and where traces of slag scatters indicated the presence of sites in particular vicinities. One area of former tea plantation – where the presence of one or more now disappeared sites could only roughly be estimated from previous notes – was selected for more detailed field survey using topsoil magnetic susceptibility to locate the sites, followed by gradiometry (magnetometry) to look at their layout and select specific targets suitable for examination by excavation.

This sequential (in this case bigger to smaller scale) method of archaeological geophysical survey was aimed specifically at this area as it was known to be an ancient smelting landscape which should respond very well to this approach where we were aiming to take a systematic approach to finding, mapping and investigating these sites in more detail. This approach yielded good results and enabled the extents of (largely invisible) slag scatters to be mapped and the central positions of furnaces to be pin-pointed to within about 25 cm. Limited 'key-hole' excavation was then carried out to test the results of the geophysical survey and to confirm the identifications of furnaces, slag heaps and the like, and to look in more detail at the survival and recover evidence as to their nature, use, layout and development. Stratified remains were recorded and samples taken for scientific analytical identification and dating.

For the first stage in the geophysical survey the target area for magnetic susceptibility survey was laid out as 100 m grids with susceptibility measurements being taken at 10 m intervals. magnetic susceptibility used in this way is a measure of the content of magnetic (or magnetically active) particles – mostly the magnetic form of iron oxide, in the topsoil.

Fig. 5: View looking north-west across the abandoned tea plantations south-west of Mziani village. Site 5/Askana V was found to occupy the centre of the low hill in the middle distance, towards the left. The still visible site of Site 1/Askana I lay very close to the lower left side of the foreground as seen here.

The results from this magnetic susceptibility survey (in this case using a Bartington MS2 susceptibility meter) were then plotted so as to produce a magnetic susceptibility concentration or ‘contour map’ of each 100 m grid. Added together in this case these show the position, main focus and approximate extent of two smelting sites, one (Site 5/Askana V), possibly seen before but subsequently lost (Fig. 5), and the other (Site 1/Askana I), which was previously investigated and was partially still visible. In addition to these more obvious foci of activity a less strong area was noted about 150 m towards the south of the area mapped for magnetic susceptibility (Fig. 6).

Next in the geophysical part of the survey process was to carry out a gradiometry (magnetometry) survey over the (hot-spot) areas of highest topsoil magnetic susceptibility to plot the layout of these areas, mainly to reveal the extent of undisturbed slag dumps, positions of any surviving furnace(s) which lay beneath the (disturbed) topsoil. A single 30 m square magnetometry grid was laid out over the main areas of slag concentration of Site5/AskanaV, the previously noted site which was no longer visible which lay in the central, northern part of the magnetic susceptibility survey area (Fig. 6).

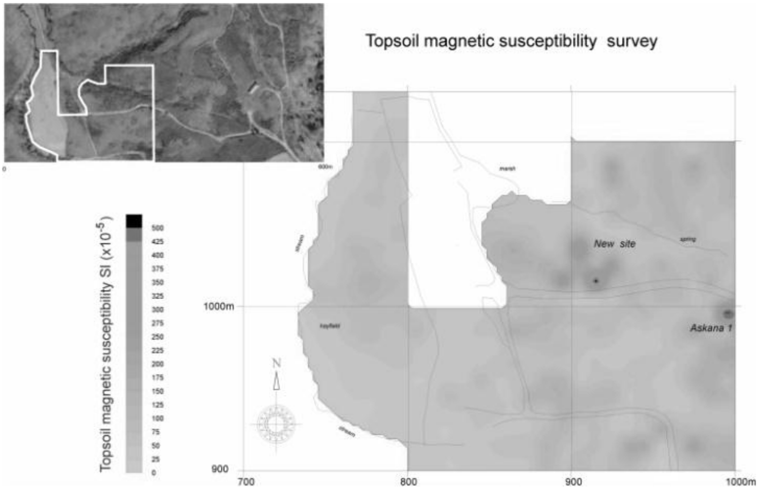
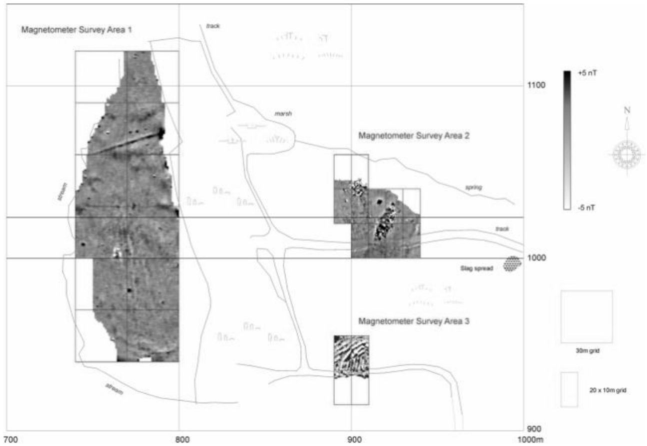


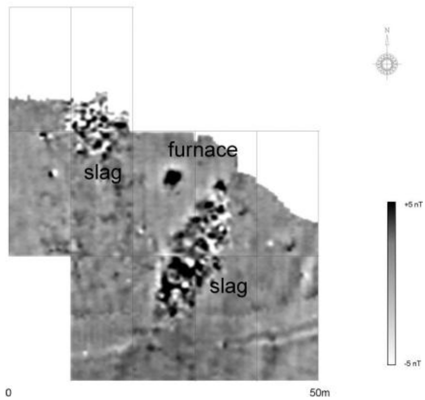

Fig. 6: Magnetic susceptibility contour map of the area to the north-west of the nearby village Mziani (but still mainly within the district of Askana) showing the areas of two smelting sites as concentrations of magnetically active particles in the topsoil (image courtesy AE Johnson)

A third grid was also laid out over the part of the area to the south showing a lower, more diffuse magnetic susceptibility concentration, this area being slightly (?50 m or so) to the west of the area where a previously noted site (Site 6/Askana?) was thought to be. The overgrown nature of the undergrowth over all this area in any case meant that only limited magnetometry was possible and that precision in targeting this method of survey was important. However, the results of the magnetometry survey over the two target areas were both very informative and interesting, and at first slightly puzzling in the case of the most southern grid surveyed (Fig. 7a).




(a)

Magnetometer Survey Area 2




(b)

Fig. 7: Overall results of the magnetometry survey over the first three areas covered, showing (a) a relatively featureless (except for a modern land-drain) meadow to the west and two former iron smelting areas to the north-east (a and b) and south-east (b), the latter having been previously disturbed (images courtesy AE Johnson).

The magnetometry results were all instructive (Fig. 7). It would appear that the flat and relatively low lying field on one side of this first study area (the paler are in the aerial view in Fig. 5) has long been used for agriculture, it being relatively featureless except for a relatively modern land-drain running across it near the northern end (Fig. 7, Area 1). This was suspected to be the case from the relatively even, low magnetic susceptibility results for this area. The north-eastern magnetometry grids were centred on the area of high susceptibility here (see Fig. 6) which was found to consist of two distinct slag scatters on either side of a furnace (Fig. 7, Area 2).

The third set of magnetometry grids was centred over a more diffuse and less intense area to the south east of the area measured for magnetic susceptibility. Interestingly the magnetometry results here gave a distinctively stripy pattern (Fig. 6a). This area was also found to be just down hill (to the west of) a deep erosion gully and careful inspection of the surface showed a wide scatter of slag but no central focus. What would seen to have happened here is that an original site situated 50m or so to the east has been eroded/washed away – probably by the heavy rains typical of the region – the slag having been re-deposited over the lower lying land downhill to the west. Subsequently this land has been ploughed, perhaps before planting of the tea bushes here, this operation having been responsible for the stripy effect on the magnetically rich topsoil here.

A similar geophysical survey was carried out in an area of land, now used as a hazelnut plantation, approx 1km north-east of the first study area. The hazelnut plantation has only been established within the past 5-10 years in an area which was formerly part of one the Soviet collective farm tea plantations. Before planting the hazelnut bushes the land was heavily ploughed, an operation which has scattered disturbed and scattered the slag dumps associated with two new prehistoric smelting sites – Site 45/Askana XXVI and Site 46/Askana XXVII – neither of which was previously noted by David Khakhutaishvili during his investigations in this area in the 1970's and 1980's.

Both sites had been heavily disturbed by recent ploughing but were investigated in 2012 using the same combination of geophysical techniques – topsoil magnetic susceptibility and magnetometry (gradiometry) plus some key-hole excavation to assess the survival of furnace remains and gather dating evidence for these, as well as to collect samples of waste remains (slag, etc.) from both sites. It was clear that the most eastern of these two sites (Site 45) had been quite heavily eroded probably well before the recent ploughing and that this ploughing had caused further damage.

## Identification, Analysis and Dating of Field Remains and Waste Residues

Most of the waste debris collected during the two seasons of work fell into two main categories; firstly slag, the wholly or partially fused stone-like by-product of the metal production at these smelting sites, and secondly sherd-like pieces of very coarse ceramic-like material which have been tentatively interpreted either as a very rough or coarse form of crucible – relating to a two-stage smelting process – although some of it may also represent furnace lining.

Overall it is clear from initial (XRF and SEM) analytical work that most if not all the sites encountered were used for copper smelting, although, as is typical of copper smelting slags, iron formed a high proportion of much of the surviving slaggy waste encountered (Erb-Satullo et al., 2014). This may to some extent have misled the earlier researchers looking at this material. More unexpected was the large proportion of zinc in the slaggy residues recovered from some of the sites investigated although this and the high incidence of iron simply reflects the polymetallic (copper, iron and zinc rich) nature of the ores known to exist in this region. Zinc being present in the slag from some sites but not others, suggested that different ore bodies – with a greater or lesser presence of zinc (Erb-Satullo et al., 2014, 153-156). Results from the earlier survey and excavation work, together with the more detailed recent work has shown the multiple use of furnaces which essentially consist of shafts sunk up to about 1.2 m into the clayey subsoil of the lower hilly part of this region, these sunken shaft furnaces being supplied from above by an air blast via multi-part tuyère tubes.

It was clear that the slag was of two distinct types, the first of which was highly inhomogeneous, relatively dense, but still quite porous with many small gas bubble holes. This contrasted with the second form of slag which was homogeneous, very dense and heavy and either contained or bore the impressions of large gas bubbles. On most of the sites seen during 2010 and 2012 both these forms of slag tended to occur together on the waste tips encountered with some sites having more of one type than the other but overall the two forms of slag had become quite mixed although originally they may have been dumped separately, sometimes they may have begun as separate slag dumps which later became merged.

This is the strong indication from our more detailed study of Site 5/Askana V where two slag dumps showed up on the magnetometry, one on either side of the central furnace (Fig. 7b). Here the more complete dump to the south-west of the furnace was found to consist almost entirely of the very inhomogeneous, more porous slag which had evidently come out of the furnace during its use and some of which, together with other mixed burnt debris, had been dumped back into the furnace when it went out of use. By contrast, the slag scatter to the north-east of the central furnace consisted almost entirely of the homogeneous, very dense form of slag. Unfortunately this slag tip was much less well preserved and much of it seems to have been lost to erosion down the steep gully to the north.

When both forms of slag are freshly broken open the occasional greenish patch can be seen, showing these slags to be the waste remnants of an early copper smelting process. Much of the slag from various sites has been subjected to routine X-ray fluorescence (XRF) analysis (using a portable Brucker device) which shows, as expected for copper smelting, the presence of a relatively small proportion of copper and a much larger proportion of iron which is also evident from the rusty appearance of some of the slag.

Initial chemical and micro-structural analysis strongly suggests that the main ore source used was a chalcopyrite ore, possibly with some weathering (Erb-Satullo et al., 2014, 155-156) The copper present in the ore will reduce preferentially to metal at the final stage of smelting leaving the iron to combine with the rocky component of the ore to form slag. This process may have been done in two if not three stages in all. Firstly the ore will need to be partially oxidised so as to make it more friable or powdery – to allow the reducing gases of the smelting reactions to penetrate the ore – and to remove some of the sulphur present. Smelting may then have been a two-stage reduction process starting with the production of a solid mass of copper sulphide 'matte' which was then further reduced to form ingots of copper metal, with slag forming as the waste by-product. The possible way in which the reduction processes may have worked in this copper smelting industry is discussed in much more detail in a separate paper (Erb-Satullo et al., 2014).

Charcoal from stratified contexts – mostly from the dumps of burnt slaggy waste – was recovered for accelerator radiocarbon dating from as many sites as possible although it has so far only been possible to submit a relatively small proportion for dating this way.

**Discussion and Conclusions: Results so Far and Future Directions**

At present we are awaiting the results from 10 radiocarbon dating samples and we have only received the preliminary results from the few OSL dating samples submitted although these do suggest that the smelting at Site 5/AskanaV, the first smelting site subjected to more detailed study during this survey, was operating in the earlier half of the first millennium BC. This is in very broad agreement with the archaeo-magnetic date of 1092+/- 100 BC obtained by David Khakhutaishvili for the nearby Site 1/Askana 1 which lay on the same hill some 100 m to the south-west, although the radiocarbon determinations for Site 5 should make this clearer.

As yet there seems no reason to doubt the overall reliability and general accuracy of David Khakhutaishvili's (radiocarbon and archaeo-magnetic) dating of the sites he investigated in the Guria region although we now know that these relate to a prehistoric copper smelting industry which in this area appears to have been operating from about the mid 2$^{nd}$ to the mid 1$^{st}$ millennium BC although it may have begun earlier and ended later.

It is still a puzzle as to why the earlier unfinished work on this region concluded that all the sites related to ironworking when, during our study of these sites, it soon became clear that they were associated with prehistoric metal copper smelting. It is possible the sites studied earlier on in the Choga village area of Samegrelo (Khakhutaishvili 1987/2009) did relate to iron smelting – although this has yet to be determined. If so the very high iron content of some of the Guria copper smelting slags, together with the close similarity of some (but not very much) of the Guria slags to the type of tap-slag associated with iron smelting sites, may have misled the earlier researchers. Our study of the Guria slags suggests that the very high iron content of these slags is partly the result of the smelting of chalcopyrite (mixed copper and iron sulphide) ores with a relatively high iron content, plus the addition of iron rich sand – perhaps more likely derived from local sandstone rather than iron sands from the Black Sea coast – as a flux to improve the copper yield, given that copper reduces preferentially to iron.

It seems most likely that by the first millennium BC copper smelting and iron smelting had already become separate specialised disciplines and would have been carried out in separate areas, where the combination of available ores, fuel in the form of charcoal – for both heat and reducing the ores – were readily available. We have a long way still to go before we understand how these prehistoric industries formed part of a system of landscape management and exploitation in the area (in this case the Supsa river region of Guria) under consideration here although this is one of the main overall questions for the present project.

The detailed mapping, recording, topographical contexts and descriptions of the sites are now mostly complete for our study area in the Supsa-Gubazeuli River region of Guria, although what is still needed is further detailed work in the form of the detailed geophysical study and archaeological excavation of one or more specific sites (or groups of sites) before we can assemble enough evidence or information to reconstruct exactly how this particular prehistoric smelting industry worked, from the exploitation and preparation of the ores through to the production of the metal itself.

We are awaiting the results of the first set of dating results but we anticipate that many more will be required before we can get a more reliable idea of the chronology and longevity of this industry, as well as understanding how long each site may have remained in operation. Linked to this, we have yet to try and work out to what extent the smelting operations moved about or stayed in one place. We presume that the landscape at the time was much more wooded than it is now, and it seems likely that the woodland landscape would have been managed, or at least exploited, quite carefully to allow for the regeneration of the fuel source, much as has recently been realised for early smelting industries elsewhere (as in the UK for the Roman and later iron industry of the Weald; see Rackham 1986). If resources and time allow, we would like study the landscape here further – perhaps with the aid of techniques such as pollen analysis – to understand better how it was managed in various ways.

We do not know for instance whether or not the prehistoric Guria copper smelting industry was carried out as a seasonal activity by local inhabitants who were also farmers, or local crafts people of various kinds. The seemingly relatively small scale of the smelting operations here and their apparent longevity and lack of change (although this has yet to be fully determined by more detailed analytical study) might argue for this industry being a long term (ie one lasting a thousand years or more) seasonal activity. However, this said, the industry may also have been the main source of income for the people who operated it since the copper seems most likely to have been made for use elsewhere, at the very least by the local or regional elite centres. Aspects such as this, as well as the linking of the industry studied here, to the copper based objects found elsewhere in western Georgia.

A key question which we are working towards is how, when and where the smelting of copper in western Georgia may have led, or given way to the smelting of iron. The late 2nd and early 1st millennium BC – that is our period of interest – is the period where we might expect to see evidence for the transition from copper to iron as the main (elite?) metal in this wider region, and this is exactly what we do see in the form of skeuomorphic objects (in this case those made of iron which mimic the forms which are suited to the making of copper based objects, but are made of iron) often found together accompanying burials or in votive hoards.

We need to link the industries we are studying to (eventual) products of these industries. In the case of bronze objects we also need to at least be able to suggest where the copper might have been alloyed with tin, as well as where the tin might have come from, and where the objects might have been made, and if processes such as recycling may have been an issue. In the case of iron artefacts, again we need to work out where the metal was being smelted, and what degree of specialisation there was on these smelting sites, as opposed to the smithing or artefact production operations carried out elsewhere. In the case of iron these considerations do not appear to relate to any of the Guria sites, although we have to be aware that this may be a possibility not far away. There may be areas of prehistoric iron smelting in Guria that have not yet been identified but are waiting to be found. In much the same way we have begun to study a small region in the mountainous region of southern Adjara, east of the town of Keda, near the border with Turkey, and we have found that this was exploited for iron smelting (although we are again waiting for the results of radiocarbon dating), although copper deposits have been elsewhere in this mountainous region (Ghambashidze 1919).

There are many issues relating both to the prehistoric Guria copper smelting industry that still need addressing, and these form part of our ongoing research in this area, but we are also beginning to study both the other areas looked at by David Khakhutaishvili during his long campaign of work between the 1960's and 1980's, as well as looking at new areas with the aim of putting together a more cohesive picture of this giant jigsaw puzzle.

***Bibliography:***


› Erb-Satullo N., Gilmour B. J. J., Khakhutaishvili N., Late Bronze Age and Early Iron Age Copper Smelting Technologies in the South Caucasus: The View from ancient Colchis c. 1500-600 BC, Journal of Archaeological Science, 49, 2014, 147-159.
› Ghambashidze, D., Mineral Resources of Georgia and Caucasia: Manganese Industry of Georgia, London: George Allen 1919.
› Gzelishvili I. A., Zhelezoplavil'noe Proizvodstvo v Drevney Gruzii (Iron Smelting Production in Ancient Georgia, Tbilisi 1964.
› Inanishvili G., About the History of Iron Production in Georgia, Metalla, 14, 1-62, 2007.
› Khakhutaishvili D. A., Proizvodstvo zheleza v drevney Kolkhide (The Production of Iron in Ancient Colchis), Tbilisi: Metsniereba 1987.
› Khakhutaishvili D. A., The Manufacture of Iron in Ancient Colchis Oxford:Archaeopress 2009 [1987].
› Khakhutaishvili N., Tavamaishvili G., One More Centre of Ancient Iron Metallurgy in Chakvistsqali Basin), Dziebani: The Journal of the Centre for Archaeological Studies, Georgian Academy of Sciences, 2002, 34-40 (in Georgian).
› Kuparadze D. M., Ancient Georgian Iron Metallurgy and Its Ore **B**ase, in Geoarchaeology and Archaeomineralogy (eds. R. I. Kostov, G. B., and M. Gurova), St. Ivan Rilski, Sofia, Bulgaria 2008.
› Mikeladze T. K., Khakhutaishvili D. A., Drevnekolkhidckoye poseleniye Namcheduri I (Ancient Colchian Settlement Namcheduri I), Tbilisi 1985.
› Rackham D., The History of the Countryside, London:Dent 1986.
› Tavadze T. N., Inanishvili G. V., Sakvarelidze T. N., Zague T. H., Issledovaniye drevnikh shlakov zhelezhogo proizvodstva na territorii Gruzii (Investigation of Ancient Slags of Iron Production on Georgian Territory), History of Science, 21-28, 1984.
› Waldbaum J. C., The Coming of Iron in the Eastern Mediterranean: Thirty years of Archaeological and Technological Work., in *The Archaeometallurgy of the Asian Old World* (ed. V. C. Pigott), University of Pennsylvania Museum, Philadelphia 1999.



***Abstract***

The work describes archeological finds unearthed and studied during a 4 year joint Georgian and British expedition (2010-2012) on the territory of south-western Georgia.

The study of early ironware is admitted to be among the most challenging areas of historical sciences. Broad scholarly interest in it is associated with the significant role of iron in early communities.

The early use of iron has been confirmed in many advanced states of the Ancient East, but iron mining and processing (early groups of iron smelting

workshops) has not so far been attested in these areas – at least to the extent to meet the local demand.

The situation is different on the territory of western Georgia (historical Colchis), where Georgian specialists have discovered and studied a significant number of large-scale mining and metallurgical centers in the last 60 years. Recent findings add more evidence to the opinion that the eastern and south-eastern Black Sea area (historical Colchis) was the important region that produced ancient ironware.

However, part of researchers question the early date of iron smelting workshops found in western Georgia (radiocarbon and archaeomagnetic dating). More specifically, they question the geophysical examination results of the 1970s-90s.

The joint Georgian-British expedition aimed to specify the date of early iron production in Colchis, which required the application of up-to-date technological methods. In this, we were closely aided by our foreign partners. Besides, earlier findings were described with the help of modern equipment and were mapped. The works also allowed us to observe the transition from iron production to bronze production to make relevant conclusions in the future.