METALWORK IN THE EARLY AVAR PERIOD: GRANULATION, FILIGREE - IMITATION

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This paper[1] is aimed at the study of granulation from a goldsmithing and of an archaeological point of view. In the first section the production and application of granulation, and that of a closely related technique, filigree is introduced. In the second half the occurrence of granulation in the material culture of the Early Avar Period is examined. Among the issues to be discussed are the evidences and possibility of local production, the decorations formed by granulas, and the relative value of granulated objects. Furthermore a chapter is devoted to deal with granulation and its imitations, but primarly the question must be formulated what can be considered as merely a sphere like decoration and what is a copy of granulation. Instead of repeatedly introducing the finds displaying granulation, it has been decided that only selected, illustrating finds shall be presented.

Filigree and Granulation from the Goldsmith's Point of View

I. Theoretical background

First of all the methodology of analysis on goldsmithing techniques should be clarified. One might underestimate the facility of comparing ancient techniques with modern ones presuming that the applied techniques must have changed considerably during the elapsed time. Consequently, one would suppose that modern methods cannot be considered as reliable data and cannot be analogous with ancient ones (Written sources are hardly available, an exception is Theophilus). Nevertheless, if the equipment found in Early Avar Period goldsmiths' burials e.g. Hérouvillette (Deceans 1971), Kunszentmárton (Csallány 1933), Poysdorf (Beninger 1966), Vestly (Müller-Wille 1983, 248-251) is compared to the equipment of contemporary goldsmiths', surprisingly no significant difference can be found. The basic tools are identical, not only in their forms but also in their size. It has to be taken into consideration that the tools found in burials display only part of a goldsmith's total equipment. The resemblance of ancient and contemporary tools is reasonable, as the chemical and physical characteristics of the given materials restrict the ways in which they can be processed. Furthermore the form and the size of the tool is determined by the objects to be made. In the handling of a tool only practical reasons are taken into account, subjective aspects do not contribute. In the Carpathian Basin – according to our present knowledge – no tools are known from settlements, neither half-ready or by-products can be cited that would unambiguously indicate the presence of a goldsmithing workshop (Bühler 1998-1999, 441, 172. footnote) in Avar environment.

In the forthcoming sections a short overview on the production of filigree and granulation – a technique already practiced in ancient Mesopotamia – is presented from the goldsmith's point of view. Both techniques were closely related in most time periods. Most frequently it is the combination of the two which appears on objects, even though the way they are produced is completely different. While granulation is composed of small metal balls (granulas), filigree employs thin metal wires. Their correlation stems from the fact that usually filigree or thin wire provides the basis and/or the framing for granulation.

II. Filigree

Filigree is an umbrella term. Its origin is unknown; still it is certain – similarly to granulation – that it is a modern denomination (Duczko 1985, 15)[2]. All processes carried out with wires and tubes

[1] I would like to thank Szabina Merva and Ádám Bollók their useful pieces of advice, which were given during the writing of this paper.

[2] The technique was first mentioned by an anonym author; it can be related to a Greek tractate dating to the eleventh century on the art of goldsmithering (Bühler 2000, 208).

can be enlisted under the term filigree, ranging from wire-, tube production, drawing, twisting, beaded-, to notched wire manufacture etc. A brief overview of the aforementioned is provided in the following chapter.

In case of filigree the base material is wire or plate, depending on whether the final product will be wire or tube. Tube is preferred due to the possibility of metal retrenchment. Determined by the thickness of the wire it can be prepared in several ways depending on the base material. The plasticity[3] of metals is permitted by the slips[4]. The smaller force is required to evoke the slips, the formable the metal is (Dzurdzik 1998, 14, 19).

Three methods are known for preparing wire or tube with appropriate diameter (square, circle or oval etc.) and thickness.

1) Hammering

Rod (which is thicker than approximately a millimeter) or wire can be stretched or formed by hammering with the help of a "forming block" (e.g. semisphere shaped carving in a metal plate). The result of the method is an uneven surface. In practice the method can be recognized by the unevenness of the wire's diameter, furthermore from the facets on the surface[5] (Duczko 1985, 16; Bühler 2000, 211, 214).

2) Drawing

A considerably easier and faster process is drawing: with the aid of a drawing plate, a wire or tube with the desired diameter and thickness can be produced either from a rod or a wire or out of a plate. This tool can be easily confounded with the "nailing plate". The distinction between the two tools is that on the nailing plate the holes have almost the same size[6], whereas on the drawing plate the size of the holes gradually increase or diminish. (concerning the exact definition of drawplate consult Bühler 2000, 208). The reason behind the construction of the drawing plate is that the base material has to be drawn through each hole until the desired thickness of the tube or wire is achieved (fig. 1; Ogden 1982, 46).

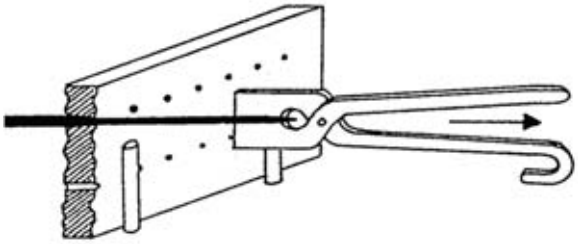

Fig. 1. Process of drawing
(after Urbon 1997, Taf. I, Abb. 2).

The identification of drawplates, and the technique of drawing (fig. 3/1) is still an unsolved problem. According to Jacobi, in Europe the technique was already applied in the La Tène Period (Jacobi 1979, 111, 115). However, the drawing plates from Staré Hradisko and Sanzeno introduced by him could have a different function. Jacobi himself suggests that the bigger one, the one iron from Sanzeno was a prodding tool for metal plates and/or leather (Jacobi 1979, 114).

Foltz questions the identification of any specimen as drawing plate, on the basis of the low number of holes on it (Foltz 1979, 217-218)[7]. Furthermore he mentions three objects among Scandinavian finds published by Müller-Wille[8], which could be suitable for drawing, even if details concerning the size of holes are unknown (fig. 2; Foltz 1989, 106). In our opinion the emphasis should be laid on the form of the holes, instead of on their number. During drawing, in other words during the execution of a cold working process, it is utterly

[3] „The ability to undergo plastic deformation without cracking" (Brown 1998, 170). This feature enables the bending, coiling, twisting, etc of metals.

[4] „Slip: Deformation by planes of atoms in the crystal lattice sliding over each other. The sliding action is facilitated by the movement of dislocations" (Brown 1998, 206).

[5] Neverteless, Foltz in connection with the study of the Wittislingen brass necklace draws the attention to the fact that at the end of the hammering process the wire's – decreased – section is chiselled by pounce or shale. This way the outer surface looks as if the wire would have been made with the help of drawplate. The structure created by smithing, distinct from the structure of drawing becomes only visible after the removal of the upper layer (Foltz 1981, 60-61; Foltz 1989, 100). This fact further complicates the recognition of the technique by macroscopic inquiry.

[6] Depending on the thickness it can be made of any hard metal.

[7] Citing Foltz, Bühler also regards as a basic criteria for drawing plate that a great number, profusely executed and in size gradually decreasing or increasing sized holes should emerge on the tool. The researchers share the oppinion regarding the function of the plate from Staraja Ladoga. It must have been used as a drawing plate. It contains 78 holes with diameters decreasing from 2 till 0,2 milimetre (Bühler 2000, 209). This specimen satisfies all the requirements of a drawing plate.

[8] Based on the foot note of Foltz 1989, 18; Müller-Wille 1977, Abb. 11/5, 11/7 and 20/8.

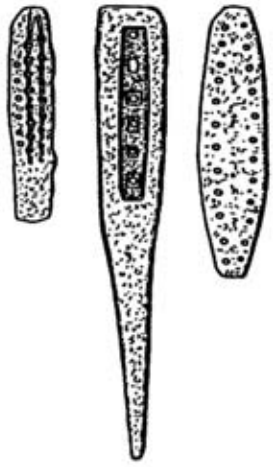

Fig. 2. Finds from Sweden. The plates on the two sides identified as drawplates by Foltz (after Foltz 1981, 61, Abb. 15).

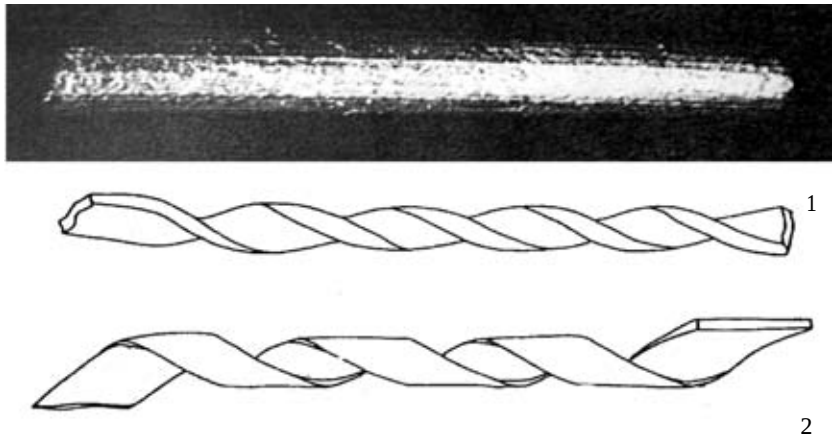

Fig. 3. 1 - Example of striations caused by drawing on the pin of recently made fake "Etruscan" fibula (after Ogden 1982, 48, fig. 4/25); 2 - strip twisting (below) and block twisting (above) (based on Ogden 1982, 49, fig. 4/27).

important that the decrease in the diameter of the base material gradually eventuates. This can only occur in case of conical holes. Simple, cylindrical holes could easily spoil the material: due to the decrease in diameter the material is compressed and it cannot dissolve evenly.

It has to be underlined that before each process and even during the specific process the material has to be softened repeatedly, since the material stiffens during forming processes[9]: due to the interfacial pressure the crystallites[10] become deformed. In order to decrease or completely nullify the tension and stiffness the processed material has to be heated to 400-600°C, so that the deformed grains recrystallize. The name of the method is derived from this process: recrystallizing. The newly built even texture enables the further cold working[11] of the material (Dzurdzik 1998, 45).

3) Twisting

The last type of method consists of the different twisting processes. These are applied in case of tube production. The two basic methods are the *strip* and *block twisting*. The starting piece is a metal strip in case of both techniques[12]. In case of the former the metal stripe is coiled spirally, like a tube, therefore the section resembles a Swiss roll. In case of block twisting the stripe is twisted in its full length (fig. 3/2), which in the end results in H-like section (the ends of H are bent on each other).

It requires a little attention to recognize the previous twisting methods on objects[13], or on parts of objects: where the ends of the stripes meet, a thin line running spirally along the wire's length – called the seamline – can be discovered (Bühler 2000, 217-226; Ogden 1982, 48-56; Foltz 1989, 99). This feature facilitates the revelation of the technique; nevertheless, defining the exact method among the twisting methods is a more elaborate question. Regarding the base material the beaded wire and notched wire should be mentioned in this section, however, these methods will be described later.

III. Granulation

The term 'granulation' is the modern appellation of the technique that was derived from the Latin 'granum', meaning barley, seed. Although the

[9] „Those processes which change the shape of material along its major axis without substantially changing its cross-section..." (Brown 1998, 95.)

[10] „...mean no more than a very small crystal. Alternatively, the term may refer to sub-crystals within a grain or to small crystals or parts of crystals which do not exhibit all the characteristics of the full crystal" (Brown 1998, 58).

[11] „Any process of plastic deformation in which the component does not recrystallize but becomes progressively harder and stronger but less ductile up to some limit" (Brown 1998, 46).

[12] The metal strip is a thin (approximately one millimetre thick) tapered plate that can be cut with plate shears. This process is not part of this paper. (See in detail: Foltz 1979, 219; Foltz 1981, 58; Ogden 1982, 34-35).

[13] With the exeptions of twisted wires applied for inlay work (Tauschierung). Due to their density, these wires can only be exemined by radiophotography.

term itself only came into existence in the eighteenth century[14] (Wolters 1983, 11), the technique was widely spread and practiced in the various historical periods with different intensity. The term is most precisely defined by Jochem Wolters in his basic monograph on granulation:

„Die Granulation ist eine Ziertechnik der Goldschmiedekunst, bei der (irgend)eine Metallkügelchen (Granalien) in ornamentaler oder figuraler Anordnung durch metallische Bindung auf Metalloberflächen (Rezipienten) befestigt werden Entsprechend wird die Ausführung dieser Technik als granulieren bezeichnet." (Wolters 1983, 11).

III.1. The prosess of granulation

The technique is based on the principle of the smallest surfaces, due to the surface tension generated by heat the small molten metal pieces take up the most optimal form: sphere. This statement is valid in case of all metals, with the difference that less heat is required to melt metals with lower melting point (gold melts at: 1063°C, silver 960°C, copper 1083°C; Pallai 1972, 11, 29).

The required amount of heat defines the parameters of the goldsmith's most important equipment: namely the size and construction of the oven end the type of the fuel. The oven heated with wood and without adding air is capable of producing 600-700°C, whereas if air is delivered into the stokehold 1100°C can be reached. The highest possible temperature can be achieved with charcoal: without adding artificial air 800°C can be produced, with providing artificial air it can be further increased to 1300°C (Wolters 1983, 50). Consequently, when the melting point of the metals mentioned above is compared to the highest possible temperature reached by the heating of the oven – it becomes apparent that without the use of a bellow no substantive work is possible. Without adding artificial air the oven is not suitable for either melting or granulation as the necessary temperature cannot be achieved.

Due to the fact that ovens used by goldsmiths are multifunctional devices, ones which have been specifically designed to produce granulas, or to any other goldsmithing technology have not yet been identified. Attempts to reconstruct ovens used for granula production focused on the reconstruction of ovens used by Etruscans (Nestler, Formigli 2001, 80-89), still, the results due to the distant geographical location and long time interval cannot be consulted concerning the Avar Period. From the Early Avar Period: small tubes that could be blow-pipes or remains of bellows are known: these are made of bronze plate and one of their ends is folded back (fig. 4; Kunszentmárton[15]; Csallány 1933, IV-V, fig. 35). These can refer to ovens that had to be operated by artificial air.

Besides the oven, the process of granulation has no special requirements regarding equipment. The first phase of granulation is the production of granulas, a process during which balls are produced from the appropriate sized metal pieces with the help of heat. Three basic methods are known to create granulas (Wolters 1983, 45-46):

1) The metal is heated on a base plate:

The advantage of heating on a base plate is that the created spheres are regular, however the method is time-consuming. The spheres become regular under the condition that previously semi-sphere shaped furrows are carved onto the plate, and the molten metal takes up the form of the furrows. Otherwise, on a plain surface the bottom of the spheres will be flat.

2) The metal is poured into water:

When this method is applied, the molten metal is poured into water through a sieve, where the metal congeals. With this method a number of granulas can be produced at once, however, these are irregular, drop like.

3) The metal is poured into a bowl filled with charcoal:

When the molten metal is poured into a bowl filled with charcoal the metal congeals forming spheres.

Subsequently, the small balls are fixed to the base, to the so-called recipient. The assigned place of granulas can be pre-carved or pre-punched preceding the final stabilization, in these cases adhesive is not required. Nonetheless, for temporary fixing the use of adhesive is frequent, the adhesive

[14] It was first formulated by Johann Heinrich Zedler in 1735.

[15] Dr. Zsófia Rácz has introduced one from Kunszentmárton and one from Kisújszállás in her doctorate dissertation. The latter specimen has a simple tube, unlike the one from Kunszentmárton, whose tubes can be pushed into one-another (fig. 4). Here we would like to express our gratitude to her for allowing us to use her work.

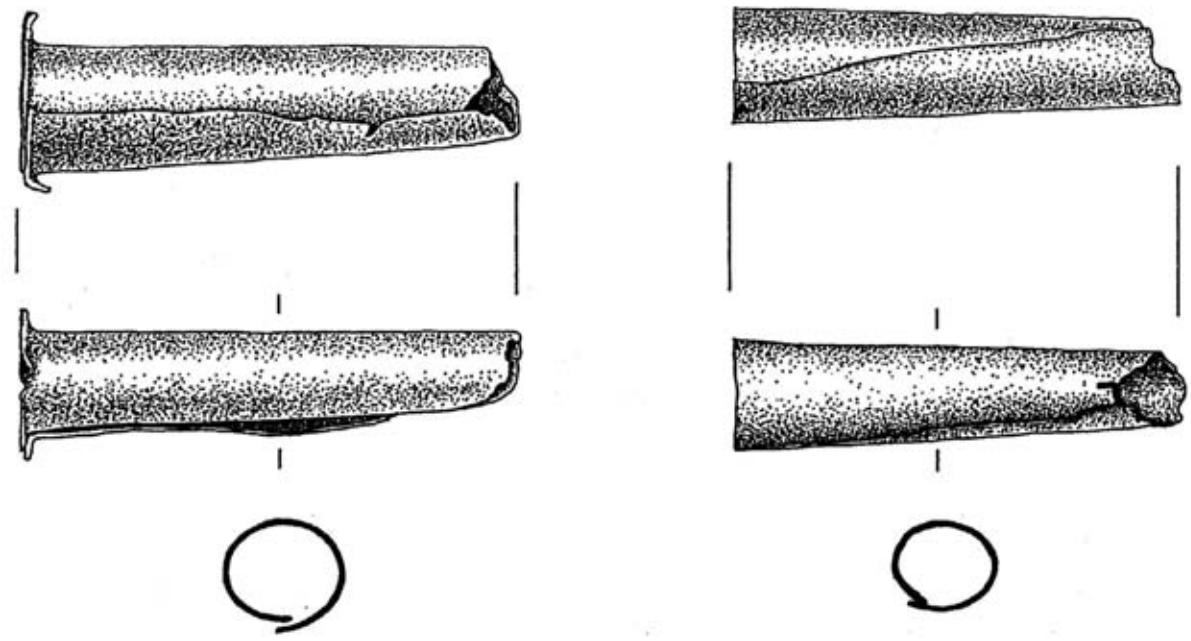

Fig. 4. Blow-pipes or parts of a bellow from Kunszentmiklós-Habranyi telep 1st grave (after Rácz 2004, fig. LXI/5).

material is blended with flux, that avails the flow (in Hungarian: "running")[16] of solder necessary for metallic bonding. As adhesive materials of floral (tragant, quince resin) and animal (glutein glues: fish glue, skin glue and bone flour) origin can be used (Wolters 1983, 48-50).

Several methods exist with which the granules can be stabilized permanently. The adhesive alone is weak and not long-lasting; its function is merely temporary, until the lasting metallic bonding develops between the recipient (a metal surface) and granulas. This can be achieved via brazing (hard soldering), or "welding" (fig. 5)[17]. The underlying difference between the two methods lies in the temperature and in the solder. In case of brazing the so-called solder is responsible for creating the metallic bonding (diffusion) between the granula and recipient (Pallai 1972, 102-103). Optimally, this solder is a metal alloy having a lower melting point (with 50°C) than the base metal has[18]. The process is executed above 450-500°C[19]. The spread of the molten solder is availed by the flux, applied with brush to the base metal. The flux could be borax ($Na_2B_4O_7$, tetraborat) – used today as well – or the nowadays less frequently applied potash (K_2CO_3, potassium carbonate). No solder is used in the process of welding; the metallic bonding is formed directly between the recipient and granulas. This bonding is achieved via the moderate heating of the two components, consequently, it requires considerably higher temperature (Farkas 2000, 148-156).

Following the final fixation the oxide layer, which appears as a result of heating, is removed. During the finishing process the objects and the granulation on it are polished with a wire brush or any other kind of tool (on the technique of granulation: Duczko 1985, 22-24; Nestler, Formigli 2001, 29-91; Ogden 1982, 58-70; Wolters 34-67).

[16] A characteristic of solders having lower melting point than the base metal is that they melt at the appropriate temperature and fill the small (macroscopically not visible) fissures, thus metallic bonding is built and the separate elements are connected. The expression flowing („running") of the solder refers to the phenomenon when the fluid solder after its fusion abruptly spreads on the surface (it runs towards the warmer parts).

[17] Here we do not mean the contemporary process, that is carried out by a welding pistol. See the explanation later.

[18] In general it is made of the material of the base metal by alloying (e.g silver with copper). Copper has higher melting point than silver, neverteless the silver-copper alloy's melting point will be lower than that of pure silver. This is a special case and characteristic (Dzurdzik 1998, 116). This way an alloy with lower melting point is gained, and the solder, even though it has different compounds from the base metal; its colour is not distinct from the colour of the recipient.

[19] Processes performed on a lower temperature are called soft soldering.

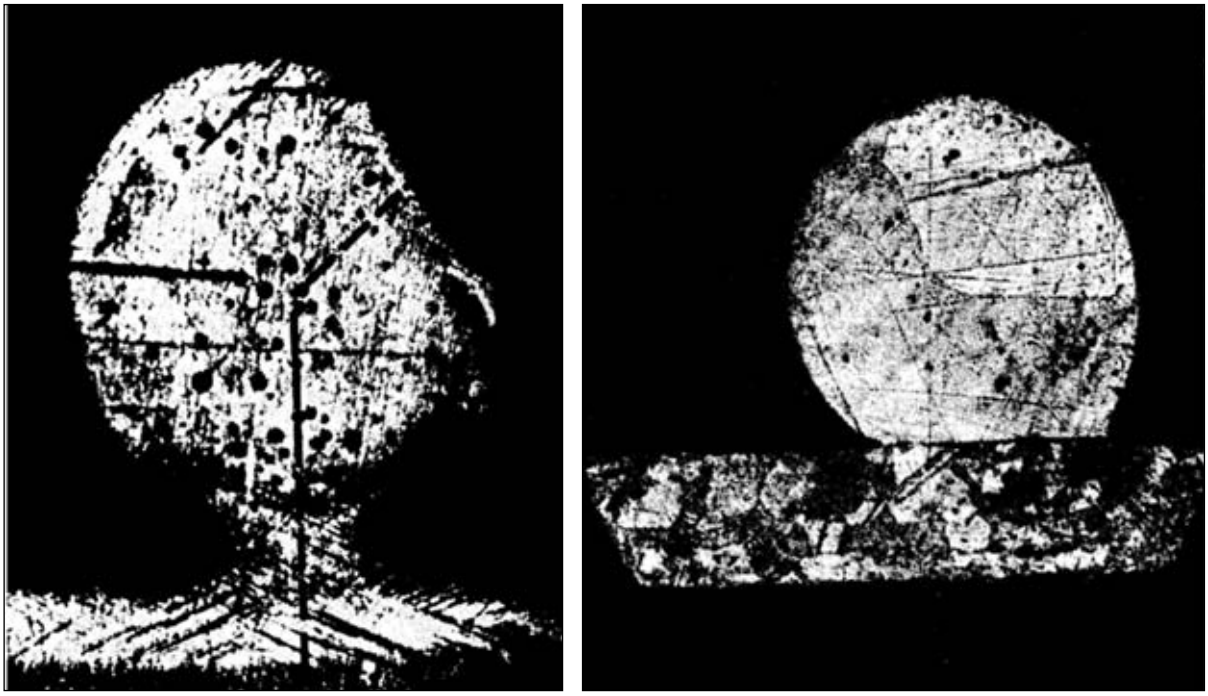

Fig. 5. Granulation made by brazing (left) and welding (right) (based on Wolters 1983, fig. 39/7, 8)

III.2. The Decorative Aspect of Granulation

Granulation as a decoration can be classified according to several different points of view: on the basis of material, the form of the granulas, the composition of the granulas and so on. Concerning the distribution based on the diverse composition created from granulas Wolters' fundamental work can be cited. Selected from his work are the compositions that occur in the mentioned period. Nevertheless, it has to be highlighted that this is a stylistic aspect that is not of primal importance to the creator of the object, to the goldsmith. According to the position of the granulas Wolters distinguishes between: single, row, surface, and grape shaped granulation (fig. 6; Wolters 1983, 14-19). Most frequently the last two categories occur in the early Avar Period.

IV. Granulation and its imitations

Granulation and its imitations require different technical backgrounds. Above all, the question has to be answered, what can be considered as the imitation of granulation and what is simply a sphere like decoration, produced because of practical or economical reasons. The earrings with hollow metal beads in the Early Avar Period were prepared by piecing together two, pressed plates. In this case creating the form was the goldsmith's chief aim not imitating. Horse harnesses often display the form semi-sphere, that can be hardly viewed as an effort to imitate granulation. With the help of press moulds sphere form could be produced quickly and easily, and this form is the main characteristic of granulation. However the sphere form in itself does not suppose granulation or its imitation.

Several *press moulds* are known from goldsmiths' burials dated to the Avar Period. A number of this could have been suitable for producing row granulation (at the first place granulas arranged in groups of three can be mentioned that can be noticed on the Szegvár and Szentendre type of earrings, and on earrings with hollow metal beads). The positive press model in Fönlak[20] (fig. 7/1) clearly indicates the attempt to imitate granulation by using a cheaper and easier method: on this form it is possible to press three small semi-spheres at once, that are joint together, their radii mutually cutting the others. Two halves could be pieced together to substitute the solid granulas. Consequently, on earrings the three or four

[20] Fettich 1926, 32, fig. VI, 7-13. Further details for the Press moulds of Fönlak see: Rácz 2004, 34-37. Positive press moulds were found in Kunszentmárton as well (both from the burials). These were suitable only to be used for pressing thin, soft sheets (Bühler 1998-1999, 431).

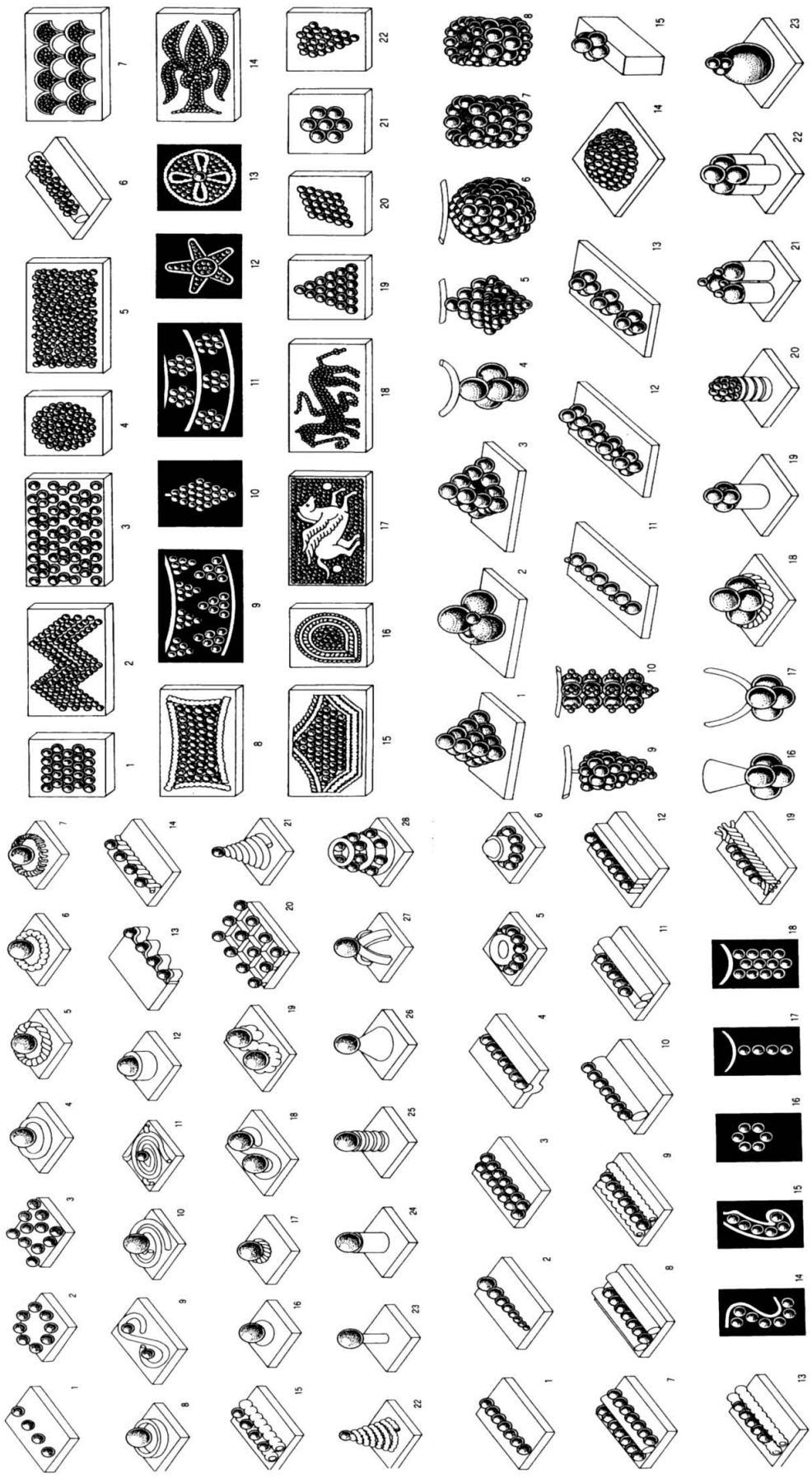

Fig. 6. Wolters' classification based on the position of the granulas: 1-28 (top left) - single; 1-19 (bottom left) - row; 1-22 (top right) - surface; 1-23 (bottom right) - granulation (based on Wolters 1983, 15, fig. 1, fig. 2/17, fig. 3, fig. 4/18, fig. 5).

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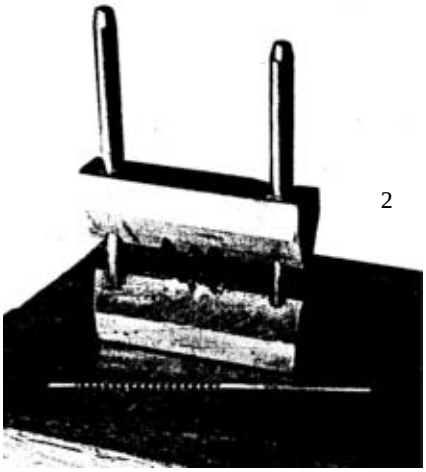

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Fig. 7. 1 - Press moulds from Fönlak (after Fettich 1926, Taf. IV); 2 - reconstructed Organarium (based on Theophylus presbyter) (after Foltz 1989, 100, Abb. 1).

spheres – placed at the junction of the ring and the big hollow metal bead – were constructed of either three or four granulas or of hollow joint spheres.

The *beaded wire* made of wire obviously was meant to copy granulation. This type of wire could be created by a single edged tool (fig. 8/1), by the so-called beading file, however, this device has the disadvantage of being imprecise. This tool is more adequate for making notched wire (fig. 8/2) than beaded wire. Birgit Bühler has noticed wire made by this tool on the great granulated belt end from the 1st grave of Kunbábony (Bühler 2000, 238).

The so-called *organarium* is known from Theophilus presbyter's book dating to the twelfth century (fig. 7/2). With this tool wire can be transformed into a series of spheres following one another (for details see Bühler 2000, 239-242). Although this is a pseudo-granulation technique, it could have accelerated the process of production and contributed greatly to the spreading of granulated decoration. The goldsmith was not compelled to work with the small, single granulas, to attach them to one another and to fix them to the base piece (Duczko 1985, 19-21). This row of spheres could have been produced by *casting*. So, granulation can also be simulated by casting as it can be noticed in case of earrings with star shaped pendants. The early specimen of this earring type with hoop or star shaped pendant are pressed and display various decoration types: beaded wire or separate granulas sit on them. However, casted pieces exist, that aim to copy beaded wire or granulation (Garam 2001, 20).

Finally one imitation type has to be highlighted: *punching* (fig. 11-12). The small points struck from the back of the plate are sometimes designed to mimic granulation. Nevertheless punching do not always aims to simulate granulation.

Granulation itself can imitate, as can be seen on the Tószeg type of earrings where stone- or glass inlay is imitated: a knob, situated on any of the metal beads or on the connecting piece is surrounded by a row of granulas resembling real stone or glass inlay.

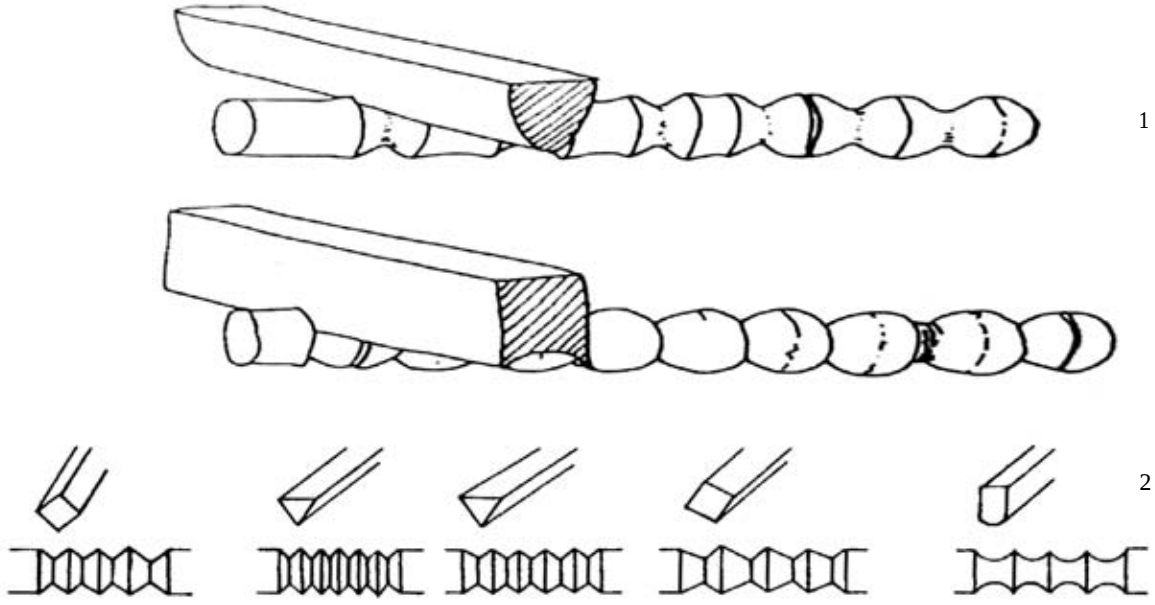

Fig. 8. 1 - Manufacture of beaded wire by a single- (above) and double-edged (below) tool (after Ogden 1982, 53, fig. 4/38); 2 - manufacture of different types of notched wire (after Foltz 1989, 103, Abb. 4).

As was mentioned before, one must be deliberate in judging whether it was the aim of the creator to copy granulation by simpler means or a distinct decoration was to be designed. Therefore only examples which can be labeled as imitation with great plausibility have been cited. To illustrate the above described a case in point is the receipt of the medallions of Hajdúszoboszló type.

Speciemen of excellent quality are registered from the 1st grave of Szegvár-Oromdűlő – 4 pieces, 3 variants – (Lőrinczy 1992, 107) and from Hajdúszoboszló (Garam 2001, 40). The occurrence of this find type is so rare that it seems reasonable to ascribe their appearence in the Carpathian Basin to the mobility of individuals rather than to trade (Lőrinczy 1992, 107). The specimen from Hajdúszoboszló is made of gold, the examples of Szegvár-Oromdűlő are electrons, altogether they display 3 variants: opposed rope twists between two granulation rows, between two granulation rows notched wire is placed and on the third variant granulas ordered into triangles can be seen (fig. 10). This jewel type emerges in several graves of Deszk, however, the creational process had been simplified: these medallions are pressed (fig. 11). The relationship between the finely worked specimen and the repousse examples is apparent: the simple plate jewels imitate the ones with granulation and filigree. The simplest imitation type was found in Előszállás-Öreghegy (Fig. 12), on which small pressed dots simulate granulation (Garam 2001, 40).

V. Summary

In conclusion it can be stated that granulation is not an utterly complex technique and special equipment is not required, however, it is essential to be acquainted with the technique. In case this technical background was not granted, the goldsmith would imitate granulation with a technique which he was familiar. On the one hand the following explanation can be offered for the imitation of granulation: the form, or the decoration was aimed to be copied without the profound technical knowledge. On the other hand, even though granulation does not require special tools, the process can be significantly accelerated by employing an 'imitating technique'. This way the goldsmith could save considerable time.

Granulation from an Archaeological Point of View

I. Granulation in the Early Avar Period

Granulation is an ancient goldsmithing technique, with which the Avars got acquainted during their east-west directed migration, presumably on the South Russian Plain (Ormándy 1995, 151). In the given time period for the immediate origin of the technique we shoud look to the Pontic workshops – responsible for spreading the technique on the South Russian Plain – which must have followed late antique – Byzantine traditions (Bálint 1993, 217-218). The origin of the technique and the origin of the objects decorated by granulation is closely related: the overwhelming proportion of finds displaying granulation in the Carpathian Basin show Byzantine origin[21]: for instance the Szentendre and Szegvár type earrings with pyramid shaped pendants (Bálint 1995, 267), earrings with star shaped pendants (Garam 2001, 20), the Hajdúszoboszló type medallions (Garam 2001, 39-40).

In the Carpathian Basin, in the culture model bearing Avar features granulation is present from the last third of the 6th century till the last third of the seventh century (Garam 1988, 165). In the Early Avar Period granulation appears on jewels: on earrings with pyramid shaped pendants, with hollow metal beads, with star shaped pendants, medallions[22]; on belt ends (the so-called Mauthner (Garam 1988, 159); Kunbábony (H. Tóth, Horváth 1992, 38-39) and on weapons: sword suspension lugs (Kecel, Alpár, Nagykőrös-Garam 1988, 162)[23].

II. Granulation as a decorative element

The group of earrings contain an abundant number of objects bearing granulation. The two widely spread earring types (earrings with pyramid shaped pendants and earrings with hollow metal beads) can be further subclassified on the basis of their decoration. J. Ormándy in his study successfully proved that granulation can connect or separate main types and variants, this way the development of these earrings could be outlined. Studied were the primal (producing process, the way of hanging the hollow bead, granulation) and secondary (identical or distinct decoration, the fixing of the lowest, closing bead, size and proportion) characteristics of the earrings (Ormándy 1995, 151). The compositions of granulas which can be observed on earrings with pyramid shaped pendants and on earrings with hollow metal beads form two decoration groups:

I. In the first, earlier group the technological aspect of granulation stands in the frontline: while granulation also has a decorative function as well, it is mainly used to connect, to hide fittings.

II. Considering the second group it is apparent that the decorative function is pushed into the foreground, the granulas are composed to form rhombs or triangles or they frame stone inlays, simultaneously the application of the technique increases.

The III. group dates to the Middle Avar Period: most commonly the granulas are situated in rows while at the same time the frequency of the decoration decreases. The appearance of the granulas is also a subject of change: the small, densely situated granulas are replaced by bigger and cruder ones. Among the decorative patterns the rhomb and triangle like compositions still can be discovered, nevertheless, instead of the surface covering small and fine granulas rough rhombs, formed by four pieces of granula emerge (Ormándy 1995, 160-161, 165). This alteration can be a result of a technical change: a new process of granula producing could have been preferred.

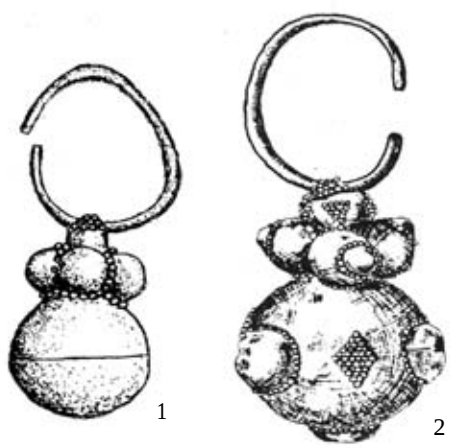

Fig. 9. 1 - Páhipuszta type earring from unknown location (after Ormándy 1995, 172, fig. 2/3); 2 - Tószeg type earring from Bakonsyeg (after Ormándy 1995, 172, fig. 2/4).

[21] The forerunner of these objects originate in the Byzantine Empire, this does not mean that their examples were produced in the Empire.
[22] In the Early and Middle Avar Periods mainly jewels show Byzantine influence (Garam 2001, 193).
[23] Here uncial objects are not enlisted.

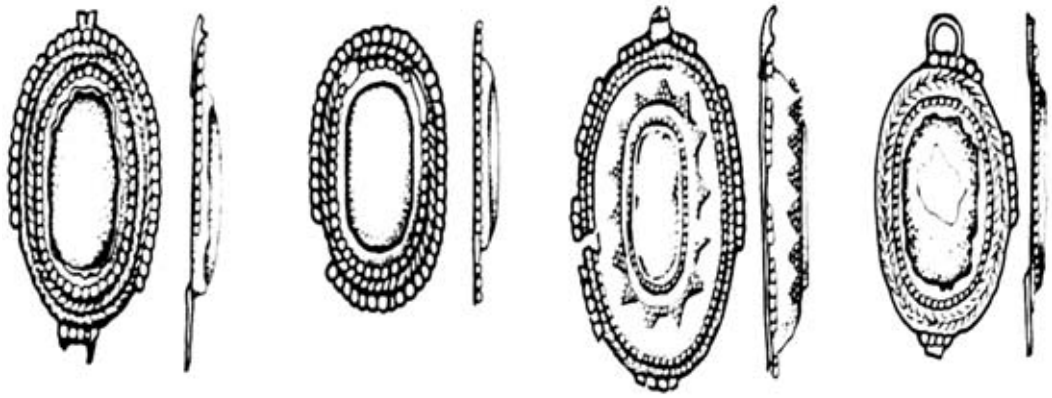

Fig. 10. Hajdúszoboszló type medallions from Szegvár-Oromdűlő 1st grave (after Garam 2001, 267, Taf. 16/3).

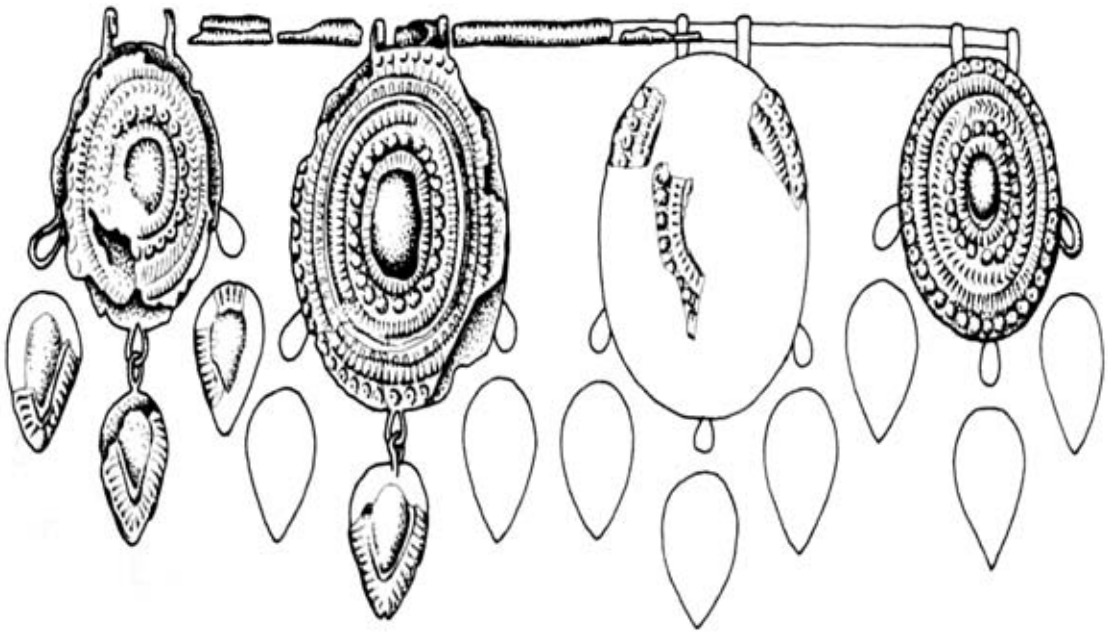

Fig. 11. Hajdúszoboszló type medallions from Deszk (after Garam 2001, 268, Taf. 17/1).

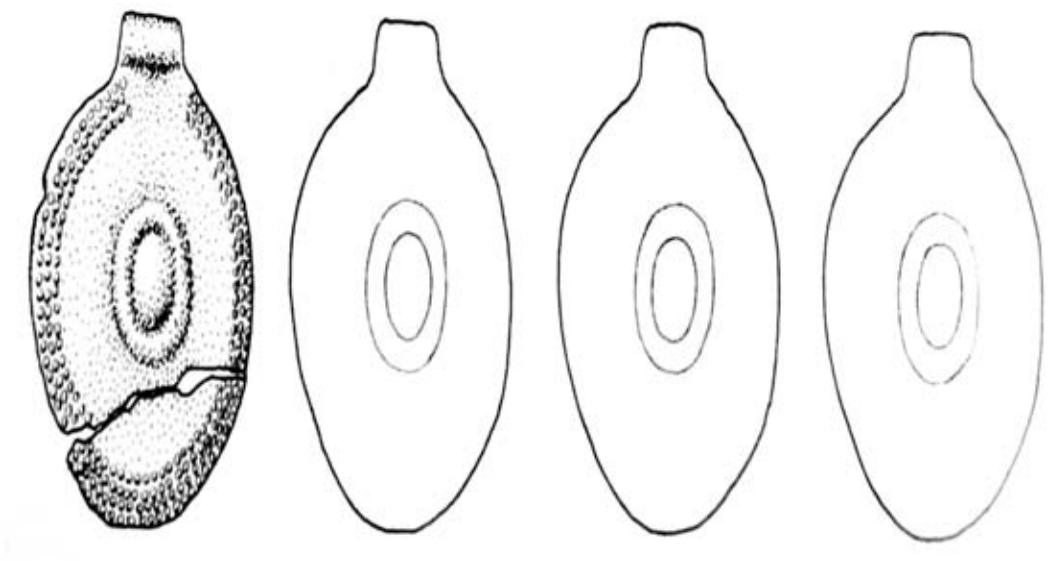

Fig. 12. Hajdúszoboszló type medallions from Előszállás-Öreghegy (after Garam 2001, 268, Taf. 17/3).

It can be noticed that the earring subtypes Páhipuszta (fig. 9/1) and Tószeg (fig. 9/2) share the same structure and are mainly distinguished by their decoration. As a chronological difference accompanies the distinct usage of granulation, the Tószeg subtype is a later variant (Ormándy 1995, 164-165).

Besides of the aforementioned decoration types, granulation also has a framing role in the Early Avar Period, it emphasizes the contour of objects or the contour of stone-or glass inlay. Granulation is frequently accompanied by filigree: beaded wire and opposed rope twists. These facts draw the attention to the various occurrences of granulation, admonishing that the above described groups should be treated as authoritative guidelines rather than rigid categories.

III. The Question of Local Production

III.1. The Relative Value of Granulation

Granulation is a relatively simple goldsmithing technique. It requires non-specific tools or equipment and it can be created from any kind of precious or non-ferrous metal, and the amount of the required raw material can be controlled by the size of granulas.

Not only the technical background of granulation but the archaeological finds prove that granulation was a relatively simple process. It is supported by the fact that granulation was applied for secondary functions as well, like covering fittings. Obviously, it does not mean that the decorative function was lost, still granulation was placed to less conspicuous places (see Páhipuszta type earrings). This is confirmed by the fact that granulation regularly serves as a complementary decoration to frame and to emphasize stone- or glass inlay.

Among granulated objects there are highly valuable finds as well, however, via the silver based variants and especially via the copper alloy replicas objects displaying granulation were used among most layers of society (Kürti, Lőrinczy 1991, 10). This serves as an evidence that granulation was not a labour intensive work as it appears on objects with modest value.

III.2 The Possibility of Localising Workshops

III. 2.1. Direct Proofs

Therefore it is highly improbable that finds alluding directly to granulation would occur, as opposed to filigree for instance. An indirect proof is the revelation of Dezső Csallány, who recognized that the earrings with pyramid shaped pendants could have been produced with the help of the pressing mould found in the goldsmith burial in Kunszentmárton (Csallány 1943, 165). This fact proves that the base object could have been produced locally, however, the question whether granulation was practiced remains unsettled. Nevertheless, it would be highly improbable to separate firmly the production of the base object and its decoration.

III. 2. 2. Ready Products

Examples of the Deszk type of earrings (earrings with pyramid shaped pendant) seem to be local products, as the spread of this jewel is restricted: it was in fashion in the area enclosed by the Tisza, Maros and Aranka rivers. For this fact two interpretations can be offered: the jewel is the bequest of a separate group of people among the Avars or it is the product of a local workshop (Kürti, Lőrinczy 1991, 10). This latter one is more probable as the wearing of these jewels is motivated by fashion not by ethnical tradition.[24]

From the number of locally produced objects the Hajdúszoboszó medallions that show genuine granulation can be educed. Due to its rare occurrence the object type was presumably brought to the Carpathian Basin by the migration of Avars, they must have been produced in workshops located at the Black Sea.

The so-called Mauthner belt end was purchased from an art collector's legacy (Garam 1988, 159), so we can only suppose that it was found in the Carpathian Basin. Nonetheless, the belt end and the belt set found in the Kunszentmiklós-Kunbábony 1st grave exhibit strong Eastern-European connections, these belts are unparalelled in the Carpathian Basin (Garam 1988, 161-169).

The Szentendre and Szegvár type of earrings with pyramid shaped pendants were delivered into the Carpathian Basin, they were products of Pontic workshops, whereas the Deszk type was produced in the Carpathian Basin.[25]

[24] The occurrence of Deszk type earrings were registered only in a few cases out of the Carpathian Basin (Bálint 1993, 218, 259; however, these finds are accumulating (Vida 2005, 235)

[25] The Avars presumably adopted the fashion of wearing these earrings during their migration, however, the jewel type could have been produced in the Carpathian Basin as well

IV. Summary

Whether the production of granulated objects at the Black Sea or in the Carpathian Basin is concerned, it can be concluded that the same high culture's influence, the influence of the Byzantine Empire can be identified. Even though these finds share similar technical and cultural backgrounds they can be subclassified if their territorial occurrence is scrutinized in a broad context.

To the early horizon of Byzantine object types which has appeared in the Carpathian Basin a Pontic group: the Hajdúszoboszló type medallions, the granulated belt mounts and perhaps the Szegvár and Szentendre type of earrings can be categorized.

The earrings with star shaped pendants can be viewed as products of local workshops operating in the area from the Balkans to the Dnieper. This jewel type is a representative of the barbarian culture emerging in the Northern bordering territories of the Byzantine Empire (Vida 2005, 237-238).

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Metalurgia în perioada avară timpurie: granularea, imitaţia filigranului

Rezumat

În articolul de faţă s-a întreprins încercarea de a studia procesul granulării atât din punctul de vedere metalurgic, cât şi arheologic. În prima secţiune este abordată problema producerii şi aplicării granulării, precum şi a unei tehnici apropiate – tehnica filigranului. În partea a doua a articolului este examinată răspândirea granulării în perioada avară timpurie.

În concluzie autorii admit posibilitatea producţiei locale (litoralul Mării Negre şi spaţiul carpatic) a pieselor granulate.

Lista ilustraţiilor:

Fig. 1. Procesul decălirii (după Urbon 1997, Taf. I, Abb. 2).

Fig. 2. Descoperiri din Suedia. Plăci considerate drept plăci pentru decălire, după Foltz (după Foltz 1981, 61, Abb. 15).

Fig. 3. 1 - Exemple de striaţii, cauzate de decălire, a acului unei fibule false „etrusce" recente (după Ogden 1982, 48, fig. 4/25); 2 - răsucirea fâşiilor (jos) şi răsucirea blocurilor (sus) (după Ogden 1982, 49, fig. 4/27).

Fig. 4. Ţevi de suflare sau părţi a unei foale din mormântul nr. 1 de la Kunszentmiklós-Habranyi (după Rácz 2004, fig. LXI/5).

Fig. 5. Granulare obţinută din lipire (stânga) şi sudare (dreapta) (după Wolters 1983, fig. 39/7, 8)

Fig. 6. Clasificarea lui Wolters bazată pe poziţia granulelor: 1-28 (stânga sus) - singular; 1-19 (stânga jos) - rând; 1-22 (dreapta sus) - suprafaţă; 1-23 (dreapta jos) - granulare (după Wolters 1983, 15, fig. 1, fig. 2/17, fig. 3, fig. 4/18, fig. 5).

Fig. 7. 1 - Matriţe pentru presare din Fönlak (după Fettich 1926, Taf. IV); 2 - organarium reconstituit (după preotul Theophylus) (după Foltz 1989, 100, Abb. 1).

Fig. 8. 1 - Producerea sârmei pentru mărgele cu ajutorul unui instrument cu un singur (sus) şi două (jos) capete (după Ogden 1982, 53, fig. 4/38); 2 - producerea diferitor tipuri de sârmă (după Foltz 1989, 103, Abb. 4).

Fig. 9. 1 - Cercei de tipul Páhipuszta dintr-o locaţie necunoscută (după Ormándy 1995, 172, fig. 2/3); 2 - cercei de tipul Tószeg de la Bakonsyeg (după Ormándy 1995, 172, fig. 2/4).

Fig. 10. Medalioane de tipul Hajdúszoboszló din mormântul nr. 1 de la Szegvár-Oromdűlő (după Garam 2001, 267, Taf. 16/3).

Fig. 11. Medalioane de tipul Hajdúszoboszló de la Deszk (după Garam 2001, 268, Taf. 17/1).

Fig. 12. Medalioane de tipul Hajdúszoboszló de la Előszállás-Öreghegy (după Garam 2001, 268, Taf. 17/3).

Металлургия в ранеаварском периоде: гранулирование и имитация филиграна

Резюме

В данной статье была предпринята попытка исследования техники гранулирования, как с металлургической точки зрения, так и археологической. В первой части статьи рассматривается сам процесс гранулирования, а также техника филиграна. Вторая часть работы посвящена изучению распространения у аваров техник гранулирования и филиграна.

В заключении авторы допускают возможность местного (Причерноморье, Карпатский бассейн) производства гранулированных вещей.

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Рис. 1. Процесс волочения (по Urbon 1997, Taf. I, Abb. 2).

Рис. 2. Находки из Швеции. Пластина, идентифицированная как волочильная доска (по Foltz 1981, 61, Abb. 15).

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Рис. 5. Гранулирование, полученное в результате пайки (лево) и сварки (право) (по Wolters 1983, fig. 39/7, 8)

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