Preface

I have great pleasure in presenting you with the Annales of the 18th congress of the Association Internationale pour l'Histoire du Verre, and I wish to thank all those who have ensured that this publication appears with the least delay: principally the authors, the academic committee, and especially the academic editors of the volume, Despina Ignatiadou, vice-president, and Anastassios Antonaras, member of the board of the AIHV for the years 2006-2012.

The 18th congress of the AIHV was held in Thessaloniki from September 21st - 25th, 2009. It was dedicated to Clasina Isings, who came, via a video, to offer us her best wishes. Here we have to warmly thank the Archaeological Museum of Thessaloniki which has organized the whole manifestation, and the Museum of Byzantine Culture, which has hosted our sessions in the brand new auditorium of the Museum, used for the first time for our congress. All our warm thanks also to The Friends of the Archaeological Museum of Thessaloniki who supported the organization of the congress among the others with the nice bag decorated with bird-balsamaria, and The Prefecture of Thessaloniki, who has hosted us at the end of the congress. Last, but not the least, from the bottom of our heart, our thanks go to Despina Ignatiadou, Anastassios Antonaras and the Organizing committee for their hard work in organizing this congress and for offering us the opportunity to meet once again to share our discoveries and our thoughts on this wonderful material, glass, to which we are all dedicated.

During the 33 parallel sessions, 95 oral communications and 55 posters were presented, displaying the vitality of research on the history of glass in the scientific world. Thanks to the energies of the Greek Committee, after a first glance at Thessaloniki at the beginning of our congress, thematic visits were organized to discover the different aspects of Thessaloniki - Hellenistic and Roman city, Byzantine city, Ottoman city, contemporary city. In the post-congress trips, the participants were able to visit the heart of Macedonia, with the cities of Vergina and Dion, and the Pikrolimni Lake, producing natron in Antiquity and still today, the ancient cities of Amphipolis and Philippi, or to make a cruise around Mount Athos.

This volume brings together 84 contributions, which cover a vast chronological span from the second millennium BC up to the present day, touching on all aspects of the history of glass with a good networking between archaeology, history of art and archaeometry. An important part is devoted to the beginnings of the history of glass in the second millennium and the beginning of the first millennium BC, and the
developments in the Hellenistic world with papers covering the Near East, Egypt and Sudan, Greece and Turkey. The Roman and Byzantine worlds are approached from two directions: the study of the production and consumption of vessels and ornaments and the expanding study on the glass in mosaic pavements and walls. The papers on the Islamic world build on the start made at the 15th congress and show the vitality of research in this area. The presentation of discoveries and research coming from the Czech Republic, Great Britain, Italy, Kosovo, Montenegro, Portugal, Poland, Romania and Serbia, fuels the debates about glass during the medieval and post-medieval period in Europe. The 18th and 19th centuries are not ignored, with papers dealing with glass in roofs, glass flowers and mosaic glass and there are also studies dealing with African and Asian glass.

During the General Assembly the board of the AIHV changed. Jan Egbert Kuipers (Treasurer) and Ian Freestone, to whom we extend all thanks for their work, submitted their resignations. The newly elected members were Irena Lazar, organizer of the 19th Congress in 2012, as Vice President, and Huib Tijssens, as Treasurer. Already present in the board, Despina Ignatiadou was elected member, were re-elected Jane Spillman as General Secretary, David Whitehouse as member, and I [Nenna] as President. The executive committee which assembled six elected members as well as the presidents of the national Associations or Committees, was partly renewed, with the election of Fatma Marii and Yoko Shindo; Sylvia Finforschling, Lisa Pilosi, Marianne Stern et Maria Grazia Diani were re-elected. We mourned during the congress the recent death of two long time members, Sarah Jennings from England and Claudia Maccabruni from Italy.

The preparations for the 19th congress are progressing under the guidance of Irena Lazar. The congress will be held at Piran (Slovenia) from September 17th to September 21st 2012 (www.aihv.org, www.zrs.upr.si). After the wider opening towards eastern Mediterranean members effectuated during the Thessaloniki Congress, we will receive in Piran more information and members coming from Central Europe.

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E. Marianne Stern

Ancient Greek Technical Terms Related to Glass Production

Ancient Greek authors developed a range of technical terms for glass production [1]. The purpose of this excursion into the realm of philology is to establish whether these terms reflect a growing understanding over time of production processes, similar to the way scholars developed new terminology following the recognition that in antiquity glass was usually made from raw ingredients in ‘primary’ workshops, but shaped and made into objects in ‘secondary’ workshops. Clarification of the technical terms’ meanings will enable us to better understand ancient texts and their implications for the history of glass production. This is not the place for an exhaustive study of all the evidence. I will discuss a few selected passages that shed light on the question of primary and secondary workshops.

Strabo (ca. 62 BCE - 24 CE) is the first Greek author to discuss raw ingredients for primary glass production (Geogr. 16.2.25):

«… μεταξὺ τῆς Ἀκῆς καὶ Τύρου τινὸς θησαυροῦ ἄγιαλος ἐστίν ὁ φέρων τὴν ἑναρμοσθέντα μὲν οὖν φασι μὴ χείσθαι, κομισθεῖσαν εἰς Σίδωνα δὲ τὴν χονείαν δέχεσθαι τινῶς δὲ καὶ τῶς Σιδωνίως ὀνεῖν τὴν υαλῖνον φάμμον επιτηδεύον εἰς χύσιν, οἱ δὲ πᾶσαι πανταχοῦ χεισθαί φασίν.»

“Between Akê and Tyre is a hilly beach which produces the sand for making glass; however, it is not made fluid on the spot, they say, but it is carried to Sidon and melted (and/or cast into ingots) there.

According to some, the Sidonians too possess the glass-sand suitable for melting, while others say that all sand, everywhere can be melted.” [2]

Speaking about the melting of sand from the Syro-Palestinian coast, Strabo uses the noun οὐοῦτα (khôneia, ‘melting, casting’) and the related verb χυσίθαι (kheisthetai, ‘to become fluid’). The verb kheisithai (with Perfect Passive κύμαι kkhymai) recalls λίθων χυτά (lithina khyta, ‘cast stones’), the phrase used by Herodotus to describe the glass earrings worn by sacred crocodiles in Egypt (History 2.69). A similar expression, χυτού λίθων ἐν (khyta lithinon hen), in an Athenian inventory of the year 329/328 BCE, refers probably to a chunk or ingot of raw glass. [3].

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These expressions originated in a time when the Greek language did not yet have a proper word for glass and followed the Egyptian and Akkadian methods of referring to glass as a manmade ‘melted’ precious or semiprecious stone [4].

Most Greek words used in connection with glass production and glass producers are compounds. They consist of a noun meaning glass plus a suffix containing the root of a verb indicating how the glass was processed. One may compare English words like glassblower, glassmaker, and so forth.

The earliest compounds are those composed with a suffix containing the root *erg, with the meaning work (cf. Greek ἔργον, ergon); the English word ‘work’ and the German ‘Werk’ are derived from the same root, which was originally pronounced as *werg. (The letter wau ‘w’ was no longer written in classical Greek.) Compounds based on the root *erg can be traced back to the syllabic ‘Linear B’ script of the Mycenaean period. The Mycenaean ‘ku-wa-no-wo-ko’ was an artisan who worked (wo-ko) with ku-wa-no: κώνος (kyanos, ‘lapis lazuli’ or ‘dark blue glass resembling lapis lazuli’), a profession that translates into classical Greek as κυανουργός (kyanourgos) [5]. For our purpose, it makes no difference whether the artisan worked with the natural or the manmade lapis (glass), because lapis lazuli does not occur in Greece. Mycenaean beads and inlays are made from glass that was imported from elsewhere, as in the workshop on the citadel of Tiryns which produced architectural ornaments of blue glass [6]; the material itself was not made in Greece. We may therefore conclude that compounds including a suffix derived from the root *erg refer to secondary production: they denote the craft or craftsman working with a specific material.

Far more numerous are compounds based on the noun υάλος (hyalos) also spelled υελ (hyl, vel sim., ‘glass’) [7] plus a suffix. They appear after hyalos became the generic word for glass in Greek in the fifth century BCE [8]. There are two groups of compounds: the first combines hyalos or hyllos with the root *erg and the second combines hyalos with suffixes derived from the verb ἐψειν (hepsein, ‘to cook, boil, or melt’). The simple form υάλας (hyala, also spelled ουαλας hoilas) does not concern us here because it is non-descriptive, like the French substantive ‘verrier’. Any craftsman involved in primary or secondary production or even a glass merchant probably could be called a hyalas as on two late antique gravestones in Athens [9].

**Hyalourgos**

The compound hyalourgos is documented in several early first-century papyri [10] and in Strabo’s Geography (16.2.25):

«... ἦκοσι δ’ ἐν Ἁλεξάνδρεια παρά τῶν υαλουργῶν εἶναι τίνα καὶ κατ’ Ἀγίυστον υαλίνη γῆ, ἢ χωρὶς οὐχ οἷον τέκτες πολυχρόνους καὶ πολυτελεῖς κατασκευᾶς αποτελεῖται, καθάπερ καὶ ἄλλοις ἄλλων μιμήτων δεῖν.»

“I heard in Alexandria from the glassmakers that there exists also in Egypt a vitreous earth without which it is impossible to accomplish the making of the polychrome and valuable artifacts, just as each (product) requires its own mixture.” [11]

Strabo applies the word υαλουργός (hyalourgos) to the artisans in Alexandria who told him about Egypt’s vitreous earth υαλίτις γῆ (hyalitis gest), one of the main ingredients for producing raw glass [12]. The primary production sites which made raw glass were concentrated in just a few areas. As we have seen, Strabo mentions the sands of the Syro-Palestinian coast and Egypt; in the first century CE, Pliny (HN 36.194) adds Campania, Spain, and Gaul. It has been known for a long time that natron, one of the main ingredients for making glass, occurs naturally in the Wadi Natrun region near Alexandria. Archaeological research has now located sands suitable for glassmaking (the vitreous earth mentioned by Strabo) as well as remains of several primary production installations in the vicinity of Alexandria; those at Beni Salama appear to have functioned as early as the first or second century CE [13].

On the other hand, glass ornaments, inlays, vessels, and other objects were fashioned at many sites throughout the ancient world. The capital of Ptolemaic Egypt can hardly have been an exception, although glass historians disagree about the type of objects produced in Alexandria in the late Hellenistic period [14].

[8] Stern 2007a, 392-397
[10] Johnson et al. 1915, 409, no. 374, line 5, spelled υαλουργός (huellourgos) with two lambdas, late 1st century BCE or early 1st century CE; Grenfell et al. 1907, 34, no. 278, hyalourgos, early 1st century CE
[12] On hyalitis gest see also Theophrastus (372/69-288/5 BCE) Lap. 49, with discussion in Stern 2007a, 396
The valuable polychrome artifacts (kataskeuas) mentioned by Strabo could have been various types of colored mosaic glass - inlays, vessels, and the like - which required raw glass of different compositions. These artifacts were made by a variety of traditional techniques [15], but they were probably not blown. The Egyptians appear to have been slow in adopting the art of glassblowing which was still relatively new in Strabo’s time [16].

Since Strabo lived in Alexandria from 25/24 BCE perhaps until 20 BCE, he would have had ample opportunity to speak both to secondary and to primary glassmakers. Thus, we cannot be absolutely sure that his hyalourgoi were active in secondary glass-working as opposed to primary production. However, the circumstance that compounds based on the root *erg were still associated with secondary production in the following centuries suggests the suffix retained its original meaning.

Two fourth-century invoices from Oxyrhynchus in Egypt inform us that the local glassworkers were organized in a guild κοινον των υελουργων (koynón tôn hyelourgon), an organization in which the members were independent entrepreneurs [17]. I have argued elsewhere that the price of the glass suggests the guild supplied window panes and also took care of placing them, “fitting out” the buildings [18]. It is not clear whether the glassworkers were responsible for making the glass itself. Diocletian’s Price Edict (PE) mentions two prices for window glass, depending on the quality of the glass. Although it states different prices for glass vessels and the raw glass from which they were made, the PE does not distinguish between window panes and the raw glass used in their production [19]. The representatives of various building trades involved in repairs to public baths at Oxyrhynchus in early 316 CE included hyalourgoi, lead-workers (molybourgoi), and plasterers [20].

My identification of the hyalourgoi at Oxyrhynchus as producers of window glass finds additional support in a mid-third-century contract of uncertain provenance [21]. This papyrus is of additional interest because it states unambiguously that one of the hyalourgoi was a woman [22]. Three hyalourgoi, two men from Koptos (a father and his son) and a woman named Sarapodora from Didyme, contract to work on the νομαζων (nomazōn, “windows”) of three baths for a smaller salary than that which they had received previously [23].

Whereas the hyalourgoi mentioned in Egyptian papyri appear to be predominately glaziers [Gläser zum Einglasen der Fenster], the word could also denote a glassblower (see below).

The ending of the substantive υελουργειον (hyelourgeion) indicates a location, in other words, the place where the hyalourgos plied his craft: his workshop. Pedanius Dioscorides (5.161), writing in the second half of the first century CE, observed that the best soot [Ruβ] for painters came εκ των υελουργειων (ek tôn hyelourgeiōn ‘from the glass workshops’). The mention of soot in connection with a glass workshop suggests to me that Dioscorides was thinking of a glassblower’s workshop whose furnace would have provided ‘quality soot’ [Qualitäts Ruβ].

The substantive υελουργεια (hyelourgia) [24] refers to the art of the hyalourgos rather than to his workshop:

Πρέποντα κόσμον τοι[ε][θεωροίτε] τάφωι. Την δέ λαμπράν υελουργειάν Θομᾶς μονάζων ζωγράφος Δαμασκόθεν [25].

A painter from Damascus named Thomas states that he created singlehandedly (τέτευχε μονάζων τετευχέ) a radiant work of glass (λαμπράν υελουργειάν λαμπραν υελουργιαν) as befitting decoration for a holy tomb (πρέποντα κόσμον το[ι] [θεωροί] τάφωι preponta kosmon tô[i] theodokhō[i] taphō[i]). In view of the fact that the hyelourgia was designed and created by a painter, I am tempted to think of an opus sectile panel [26] (Mosaik aus flächigen Stücken). Bruneau suggested a figural (?) floor mosaic [27]. Another possibility is a painted glass platter [28]. Establishing the original context of the painter’s statement will hopefully shed more light on the date and technique of his creation.

[16] Stern 1999b, 443-444
[18] Stern 1999b, 464-466
[19] PE 16, 1-9, cited after Giaccher
[20] POxy vol. 64 (1997) no. 4441, col. ix
[21] Skeat 1974, xxxiii “from the Panopolite nome”
[22] On women glassblowers: Stern 1999b, 454
[23] Frisk 1929, 16-18. The 4th-century date suggested there has been revised to mid 3rd century by Skeat 1964. xxxiii; he suggests that “the baths and the public buildings to which they were attached were situated in Panopolis”.
[24] Gasparetto 1975, 112 cites Paulus Aegineta, De re medica (7th century) as evidence for a substantive hyalourgia, meaning workshop, but Trowbridge 1930, 50-51, n. 16, argues convincingly that the manuscript is erroneous and the correct form must have been hyalougeion.
[26] As in Ibrahim et al. 1976
[27] Bruneau 1988, 54. He does not mention the source of his hyelourgia, but he says it occurs only once.
[28] As published by Nenna 2003
The adjective υαλουργικὸς (hyalourgikos, also spelled hyelourgıkos; 'glassworker’s, of a glassworker’) was in common use from the fifth century CE onward, especially with reference to a type of furnace used by alchemists. The adjective does not yet occur in alchemistic papyri, but from the fifth century on, Greek alchemists often recommend the use of a υαλουργική κόμνιος (hyelourgikē kaminos; ‘glassworker’s furnace’) for preparing various recipes [30]. The verbal form, υαλουργεῖν (hyeloureîn also spelled hyalourgeô ‘to work with glass’) is found in Byzantine texts [31].

**Hyalepsos**

The second group of compounds interesting us are those formed with ἐγεν (hepsein ‘to cook or smelt’). If we are looking for a craftsman associated with primary production, this new compound, with its association of fire and heat, would be the most appropriate. 

Υαλέφος (hyalepsos, also written hyelepsês, hyalopsos vel sim., ‘glass smelter’) [32] is documented for the first time in fifth-century CE texts, as in Olympiodorus commentary on Aristotelēs’ Meteorologica and in Hesychius’ lexicon, who explains it as hyalourgos [33]. The noun and its adjective hyalepsikos occur in alchemical and other texts, but seem to be rare in documentary papyri. The electronic database DDBDP lists just one example, in a list of expenses dated seventh to eighth century CE [34].

Several texts employ the word hyalepsos (vel sim.) to designate an artisan who can hardly have been anything other than a glassblower. Bishop Leontios (fl. ca. 615 CE) composed a Life of Symeon Salos, also known as Symeon the Fool, who lived in the sixth century. Leontios writes that Symeon and other beggars used to visit a hyelopsos in Emesa (mod. Homs in Syria) to warm themselves at his furnace [35].

Ἡ δὲ πάλιν ἀπὸς καθήμενος μετὰ ἀδελφῶν καὶ θερμαίνους πλησίον τοῦ καμίνου τοῦ υελοφοῦς. ἢ δὲ τοῦ υελοφοῦ Εβρᾶος, καὶ λέγει τοῖς πτυχοῖς παῖζον “θέλετε ποιο υμα̃ς γελάσεις; ιδιο κατὰ ποτήριον ὁ ποιεῖς τοι̃ς ποιο σταυρόν καὶ κλάσεται.” ὡς σὺν ἐκλάσεισ ενορδίνως καὶ επί, ἢρξατο γελάν ὁ πτυχός καὶ εἶπαν αὐτό τὸ πράγμα καὶ ἐκδιδόναν κατερράγησαν αὐτὸν. ὡς σὺν ἐπίρημο, ἐκεῖνον ἀπῆλθεν “οὖντος, μάξῆρη, ἐν ὑμα̃ς ποιήσας εἰς τὸ μέτοπον σου σταυρόν, ὅλα συντρίβονται.” καὶ κλάσας πάλιν ἄλλα δεκατρία ενορδίνως κατερράγησαν καὶ ποιεῖς σταυρόν εἰς τὸ μέτοπον αὐτὸ, καὶ οὐκέτα ἐκλάσεις τίποτε. εἰ τούτῳ σὺν τοῦτο πεμπὼν ἀπῆλθεν καὶ εγένετο Χριστιανός.

“Another day, he was sitting again with his (beggar) companions and warming himself at the little furnace (kaminion) of the hyelopsos. The hyelopsos was a Jew. He (Symeon) said to the beggars jestingly: “Do you want me to make you laugh? Watch! I will make the sign of the cross over the cup which the tekhnités (‘craftsmen’) is fashioning and it (will) break.” When he had broken seven in a row, the beggars began to laugh and explained the matter to him (sc. the artisan), whereupon he chased Symeon away after branding him with his red hot blowpipe. When the artisan went back (to his furnace), Symeon shouted after him saying “they will all continue to break, until you make the sign of the cross on your forehead.” After he had broken another thirteen glasses in a row, the artisan gave in and made the sign of the cross on his forehead, and never broke another piece. In this way he went and became a Christian.”

A gruesome miracle associated with Menas, patriarch of Constantinople in the mid sixth century, involves a Jewish glassblower who was so outraged when he learned that his son had eaten leftover Eucharistic bread with his Christian fellow schoolmates that he took the boy to his ἐργαστήριον (ergasterion “workshop”) and threw him into the κόμνιος (kaminos “furnace”). The son miraculously survives the flames, whereupon he and his mother convert to Christianity. The father refuses to convert and Menas sentences him to death as a parricide. The story has come down to us in two versions. In the one, the father’s profession is given as hyalourgos [36], in others as hyelopsos [37].

Small workshops like those of the Jewish glassblowers described above must have been common in the early Byzantine period. The introduction of the new compounds hyalepsos and hyelepsikos (vel sim.) can perhaps be explained by the increased use of crucibles and/or tank furnaces for remelting raw glass inside the furnace as opposed to picking up chunks of glass preheated outside the furnace and melting them individually on the tip of the blowpipe, an operation called ἀρπαξίζω βοίλον (harpazein bōlon ‘snatching a chunk’) [38].

[29] Halleux 1983, index
[31] Schönauer 2008
[32] Liddell-Scott-Jones, Greek Lexicon
[33] Trowbridge 1930, 50-51
[34] Cf. Bilabel 1924, 151, no. 97, line 35
[35] Ryden 1963, the cited paragraph is on p. 163. For a translation into Dutch, see Aerts and Hokwerda 2006. For Roman and late antique glass from Homs: Abdul-Hak 1965.
[37] Migne 1894, 687
[38] POxy vol. .50 (1983), no. 3536; cf. Stern 2007a, 349-354; eadem 1999b, 452-454
Visitors saw with their own eyes how the glassblower gathered molten glass from his or her furnace. An ancient onlooker would not have questioned how the glass got into the furnace any more than a modern spectator watching a glassblower at work. The new terms were inspired by the ‘cooking’ or ‘melting’ of the glass. The Greek-speaking world marveled that white-hot flowing glass could be transformed into a tangible, stable object. Similarly, the English and German languages stress the fact that glass can be shaped by something as intangible as human breath.

One is reminded of Pliny’s flatu figurare (HN 36.193).

Conclusions

The compounds formed with *erg and hepsein do not reflect a distinction between secondary and primary glass production as suggested in the past [39]. However, it does seem that the two groups of words were used differently. Hyelourgos had a broad meaning. It applied to all artisans working with glass, designated predominately the hepsein, suggesting heat and melting. The Byzantine meaning, as is to be expected from the meaning of the other hand, appears to have had a more restricted meaning. It applied to all artisans working with glass, whether it was cold working or hot working. The hyalourgos might produce inlays, ornaments, vessels (blown or made by other techniques), or architectural glass such as window panes, opus sectile panels, and, (blown or made by other techniques), or architectural glass such as window panes, opus sectile panels, and, perhaps, figural wall or floor mosaics. Hyalepsos, on the other hand, appears to have had a more restricted meaning, as is to be expected from the meaning of hepsein, suggesting heat and melting. The Byzantine texts cited above suggest that hyalepsos and hyalepsikos designated predominately the glassblower and his furnace.

[39] Stern 2007b, 777. For linguistic evidence suggesting that the compound hyalepsos referred originally to a primary glassmaker, see Stern forthcoming.

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