

HEDVIKA SEDLÁČKOVÁ\* and DANA ROHANOVÁ\*\*

FROM RENAISSANCE TO BAROQUE:  
GLASS IN THE 2<sup>ND</sup> HALF OF THE 17<sup>TH</sup> CENTURY  
IN MORAVIA, CZECH REPUBLIC

Glassmaking in Central Europe experienced a new start and development after the end of the Thirty Years' War. Renaissance-style glass with improved potassium-based composition continued to be made with traditional technologies but ca. from 1670s some efforts appeared in glassworks in Bohemia to produce new Baroque glass that resembled mountain crystal. The glass was more convenient for new decorating techniques, such as cutting and engraving<sup>1</sup>.

Glass items from the Baroque period which have been preserved in museum collections are mostly products of high quality, however, they do not represent the glass commonly used. Those exhibits are premium items which can hardly demonstrate changes in shape and introduction of new technological procedures. A more realistic picture is provided by items found during archeological surveys which include pieces of substandard quality used by common consumers<sup>2</sup>.

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\* Archaia Brno o.p.s., Bezručova 78/15, 602 00 Brno, CZ.

\*\* University of Chemistry Technology, Prague, Department of Glass and Ceramics, Technická 5,166 28 Prague 6, CZ.

<sup>1</sup> Drahotová *et al.* 2005: 195-197.

<sup>2</sup> Description of all aspects of glass transformations from the Renaissance period to the Baroque one has become one of the objectives of the project focusing on a little known situation in the Central Danube Region, i.e. in the regions of South Moravia, Western Slovakia and Lower Austria. Supported by the grant: GAČR: P405/12/1411: Renaissance glass and beginnings of Baroque glassmaking in archaeological finds from the Central Danube Region.

So far, the situation has been documented best with glass findings from towns in the south of Moravia, specifically Kroměříž and Brno. Glass from a potter's house in Kroměříž was very well dated to the 2<sup>nd</sup> half of the 17<sup>th</sup> century based on related written documents. The house with a workshop inside the town fortification was bought in 1644 but in the early 18<sup>th</sup> century the workshop was moved outside the town walls.

With only a few exceptions, the set of several tens of vessels was obviously made in one glassworks. It includes shapes like ewers, smooth beakers and mugs that did not occur before the middle of the 17<sup>th</sup> century (Fig. 1). Its specific features include thick fibers at the bottom, several times indented, and strips on the bodies indented with a tracing wheel. The vessels were made of substandard quality greenish glass (a greenish shade of glass is caused by presence of Fe oxides introduced by ash).

Surface of most of the items was corroded – there was a brown transparent layer of corrosion products. However, this type of corrosion is more frequently seen on glass made in Bohemia during the Gothic period. Chemical analyses have confirmed that, based on the shape typology, this Baroque glass was made by means of an already obsolete technology, which was typical for the Gothic period in Bohemia (high content of  $K_2O$  and low content of  $SiO_2$ )<sup>3</sup> (Table 1, A1 and A2). The same products can be sporadically found also in other Moravian towns. Our last research shows, that this type of the glass was produced in an area of today's Hungary.

Several sets of glass from the 2<sup>nd</sup> half of the 17<sup>th</sup> century found in refuse pits in Brno were investigated. Changes in their style can be observed on all vessels with typical Renaissance shapes. Instead of **goblets** with cups of semi-ovoid and spindle shapes, which had been popular until the middle of the 17<sup>th</sup> century, there were goblets with chalice-like cups in the Renaissance style made of greenish glass but also goblets with massive stems made of Baroque glass, sometimes decorated with a wheel.

Another innovated shape were **beakers**. Cylinder shapes with optic decorations and fibers wound around the bottom were

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<sup>3</sup> Sedláčková and Rohanová *et al.* 2014.

replaced with simple beakers without any treatment of the bottom, sporadically also on three legs. Some sets from Brno contained even several tens of such beakers. Other previously unknown decorative elements were nets from partly melted fibers or stamped prunts and also cutting. They were made of poor quality greenish glass and fewer of them from colorless glass. The same refuse pits included pieces with Renaissance decorations cut with a diamond point and also with Baroque decorations engraved with a wheel and sporadically also painted with *schwartzlot*.

Chemical analyses have confirmed that they were made using the (in Bohemia) typical Renaissance glassmaking technology. The ratio of alkaline components ( $K_2O/CaO$ ) was close to one and the content of  $SiO_2$  increased (up to 65 wt. %). The content of ca. 1 wt. %  $P_2O_5$  suggested the use of ash.

The ultimate products of Renaissance glass are **goblets and lids** – with ‘dragon heads’, ‘winged serpents’ or ‘rosettes’. Some of them have twisted stems with fibers of red or blue glass inside (Fig 2). This luxurious glass *à la façon de Venise* comes from the refuse pits at aristocratic palaces and in a Minorite monastery. Similar products had been produced by Buquoy glassworks in South Bohemia as early as in the middle of the 17<sup>th</sup> century<sup>4</sup>.

An analysis of glass from the stem with a dragon head has shown that the chemical composition of glass is different from typical Czech Renaissance glass (Table 2, A1). The glass has a lower content of alkali and a higher content of  $SiO_2$  (up to 69 wt. %) and small amount of  $Na_2O$ , which was probably added as NaCl. The twisted stem was made with an admixture of ash (presence of  $P_2O_5$ ). The red color of the fiber inside the stem was achieved by copper (Cu) and iron (Fe) oxides (Table 2, A2). In this case copper (II) oxide was reduced by iron (II) oxide to produce clusters of atomic copper (0). A similar effect is known from the red stain glass panes.

Products from the late 17<sup>th</sup> century found in the refuse pits included typical Baroque beakers made of thick colorless glass with rich cut decorations. Some items also featured floral and guild

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<sup>4</sup> Drahotová 2002: 13-17.

motifs and chinoiseries. This type started developing approximately in 1680/1690 in glassworks in Bohemia and it was used mainly on simple beakers<sup>5</sup>. The beakers must have been widespread as documented by numerous archeological finds in towns in Moravia, in Bratislava but also in Belgium and the Netherlands<sup>6</sup> (Fig. 3).

The chemical composition of glass indicates that the employed technology was more advanced (Baroque) as the glass batch contained no ash. The absence of ash made it possible to produce colorless crystal glass.  $As_2O_3$  started to be used for refining of glass (and probably also for decoloration of residual Fe from the glass sand). Table 3 shows the composition of transparent glass from beakers faceted by cutting. Glasses of similar type and composition were found also in the east of Bohemia in the town of Chrudim<sup>7</sup>.

Two jugs from the last decades of the 17<sup>th</sup> century have soft S-shaped profiles that distinguish them from shapes of Renaissance jugs. The new shape and new decoration technique (combed decoration from dark blue glass on light blue body of the vessels) was used on the two items which are similar in terms of size and appearance but their opaque glasses were made with slightly different technologies (Fig. 4).

The inner opaque glass on both the jugs was opacified with a substance with high phosphorous content (bone meal) (Table 4, A1 and A3) The torso of the other jug was additionally opacified with  $SnO_2$  which had been used to produce white (lead -silica) *filigrana* glass. The blue color of the both jugs (Table 4, A2 and A4) was achieved with a raw material containing cobalt (Co is known as an intense, the so-called 'ionic' colorant). The use of  $As_2O_3$  in the case of the blue glass jug torso (Table 4, A4) classifies the glass as more advanced Baroque technology.

### *Conclusion*

A small set of glass finds of typically Baroque shapes from Kroměříž has shown that an obsolete Gothic glassmaking

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<sup>5</sup> Strasser and Baumgärtner 2002: 242-243, cat. No. 138.

<sup>6</sup> Kotmann 1999: 943, cat. No. 9-18; Henkes and Veekman 1999: 66-67, cat. No. 48-50.

<sup>7</sup> Rohanová 2012: unpublished results.

technology was still used in the 2<sup>nd</sup> half of the 17<sup>th</sup> century in Hungary. At the same time, Renaissance technologies were used which culminated with products *à la façon de Venise* were used in South Moravia and Bohemia. A modified technology started to be used at that time to produce colorless glass, without admixture of beech ash. The glass crystal made by that new technology was colorless and its properties made it ideal for decorations with engraving and cutting. A turning point came approximately in 1680/1690 and the glass made thereafter was only Baroque, both in terms of composition and style.

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Tab. 1 - Chemical composition of glass found in Kroměříž [wt %], measured with XRF (A1) and SEM/EDS (A2).

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	CaO	Na <sub>2</sub> O	MgO	P <sub>2</sub> O <sub>5</sub>	MnO	FeO*(Fe <sub>2</sub> O <sub>3</sub> )
A1	57.2	1.7	23.1	14.0	0.1	1.9	0.4	0.6	0.2
A2	55.7	2.1	23.2	13.7	0.4	1.3	0.9	0.3	0.5*

Tab. 2 - Chemical composition of twisted stem with a red fiber (Brno, Mečová 2) [wt%], measured with SEM/EDS.

Glass	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	CaO	Na <sub>2</sub> O	MgO	P <sub>2</sub> O <sub>5</sub>	MnO	FeO	CuO
A1	64.9	0.7	14.7	9.9	1.8	1.9	0.9	0.5	0.4	n.d.
A2 red	61.5	1.1	14.0	11.6	2.3	2.2	1.2	0.6	2.0	4.5

Tab. 3 - Chemical composition of faceted crystal glass (Brno, Mečová 2), [wt%], measured with XRF.

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	CaO	Na <sub>2</sub> O	MgO	P <sub>2</sub> O <sub>5</sub>	MnO	FeO	As <sub>2</sub> O <sub>3</sub>
[wt%]	70.5	0.2	17.9	8.7	0.6	0.1	0.1	0.1	0.1	1.2

Tab. 4 - Chemical composition of opaque jugs with blue combed decoration (the whole jug A1 and A2, jug torso A3 and A4), (Brno, Jakubské náměstí) [wt%], measured with SEM/EDS.

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	K <sub>2</sub> O	CaO	Na <sub>2</sub> O	MgO	P <sub>2</sub> O <sub>5</sub>	MnO	FeO	CoO	SnO <sub>2</sub>	As <sub>2</sub> O <sub>3</sub>
A1	62.4	1.9	14.5	9.8	2.6	3.5	<b>4.6</b>	n.d.	0.4	n.d.	n.d.	n.d.
A2 blue	71.4	2.1	12.2	6.6	1.7	2.3	1.4	n.d.	1.5	0.6	n.d.	n.d.
A3	59.6	2.0	16.7	8.3	2.8	3.2	<b>4.6</b>	0.3	0.6	n.d.	1.7	n.d.
A4 blue	74.5	1.9	13.3	2.1	2.6	0.7	0.6	n.d.	1.0	0.5	n.d.	2.4



Fig. 1 - Ewer made of greenish corroded glass in Hungary, after 1644. Kroměříž, Riegrovo náměstí (Photo by Hedvika Sedláčková).



Fig. 2 - Twisted stem of a goblet with dragon heads and red fiber inside, after ca 1670. Brno, Mečová Str. 2 (Photo by Miloš Strnad).





Fig. 3 - Beaker with cut decoration, crystal glass, after 1680/1690. Brno, Mečová 2 (sun flower)  
(Photo by Miloš Strnad).



Fig. 4 - Jug and jug torso made of white opaque glass covered with a layer of blue glass and combed decoration, end of the 17<sup>th</sup> century. Brno, Jakubské náměstí restoration: M. Špačkova (Photo by Miloš Strnad).