

Dr. Edward Browne's visit to the mining towns of Lower Hungary in 1669

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Abstract

EDWARD BROWNE, an English medical doctor visited the copper mine of Herrengrund (Špania Dolina, Úrvölgy; Zvolen county) in Lower Hungary during his travels in 1669. His observations were published in the *Philosophical Transactions* of the Royal Society of London. An annotated Hungarian translation is published here. Minerals collected by BROWNE have been preserved in British collections. Contemporary scientific description of the specimens by NEHEMIAH GREW and JOHN WOODWARD provide insight into mineralogical thinking of the late 17th century.

Travelling and science

Travelling as related to the evolution of sciences is an attractive, although probably not new, aspect of research. MAĆZAK and TEUTEBERG (1982) introduced the term *Reiseforschung*¹. A recent symposium (WYSE JACKSON, 2004) extensively discussed the reasons for and results of geological travel.

A literary scholar, KOVÁCS (1985, 1988) published mostly diaries of students and noblemen travelling abroad, emphasizing their obeyance of the rules of travel handbooks. Unfortunately, observations of foreign travellers in Hungary remain less known. While several modern treatises discuss their activities through the centuries (e.g. TARDY, 1982 and GÖMÖRI, 1994), these compilations are mostly for the general reader. There seems to be a lack of studies evaluating their influence on science, history, ethnography, or politics.

A recent volume of essays (RÓZSA, 1999) on ROBERT TOWNSON, an English polymath and his travels in Hungary in 1793 set a standard for subsequent studies. TOWNSON's observations in the fields of geology, mineralogy, botany, entomology, and ethnography has received specialist attention. This paper is an attempt to follow the example by studying the some of the mineralogical heritage of the learned EDWARD BROWNE, an English medical doctor who travelled in Lower Hungary in 1669, collected minerals, and published his observations.

Scientific inquiry

Scientific societies, especially one of the first of them, the Royal Society of London exerted considerable influence on where and how scientific information was gathered and communicated. By supplying travellers and residents with printed 'inquiries', i.e. lists of questions to be answered by observation (SPRAT, 1667), a great amount of written reports were received, together with samples and specimens of the object under scrutiny. These reports, often communicated at the weekly meetings of the Society, helped to establish the new, critical method of scientific intelligence through multiple checks of data. Subsequently many of them found their way to be printed in the *Philosophical Transactions*. Specimens of significant and curious objects were then deposited in the

¹ Travel research.

Museum. Less than two decades of collecting made necessary to publish a catalogue of the Museum, scientifically organised and described by doctor GREW (1681).

Most of the inquiries – published anonymously – were assembled by Robert Boyle², who was the spiritus rector of the society (KEAREY, 1971, p. 178). Several papers of BROWNE (1670a—c) were written as replies to these inquiries.

BROWNE and his age

EDWARD BROWNE, elder son of THOMAS BROWNE (of *Religio Medici* fame) was born in 1644 in Norwich, England. He studied medicine in Oxford and London. Between 1668 and 1673 he travelled extensively in France, The Low Countries, Germany, Italy, Austria, Hungary, and Turkey. He published two books (BROWNE, 1673, 1679) and several scientific papers on his observations. Browne was good observer, having interests mostly in mining and minerals.

Upon return from the Grand Tour, BROWNE started a successful medical practice in London. He was doctor for the royal household and became president of the College of Physicians. He died in Northfleet in 1708.

BROWNE's *Grand Tour*, especially his travel in the Low Countries deserved a study of monographic magnitude by STRIEN (1997). The doctor's description of the land, people, and customs, through observation of daily life, assessed together with the diary of another British traveller, JOHN LOCKE,³ recorded both life of the country and the views of the travellers as well.

Making the *Grand Tour*, a trip completing the education of wealthy and noble young men yielded hundreds if not thousands of reports, diaries, novels, discussed in a rich secondary literature (for a recent review see e.g. BLACK, 1985). STOYE (1989) and STRIEN (1993) deals with travels in the 17th century, emphasizing different approaches of the young people. Both authors agree that travellers with scientific interests were extremely rare.

BROWNE's two volumes are rich source for all kind of information: those on medical history are have been extensively studied by NEUBURGER (1917), THORNTON (1954) and LEVENTAL (1982).

Historians of the successor states of the former Austrian-Hungarian empire translated and analysed Browne's descriptions about their respective countries: for Austria POYNTER (1948), for Serbia NOVAKOVIĆ (1891), POPOVIĆ (1933—1934), and KOSTIĆ (1973) for Macedonia LEVENTAL (1963). Besides a rich selection and translation from the *Travels* by SZAMOTA (1891) there are numerous short papers, recording the trip and emphasizing the good observations of Browne (HONTI, 1969, 1974, 1979; BUGYI, 1973). A facsimila edition (NEHRING, 1975) provided a sketch map of Browne's itinerary and identified several geographical names used by Browne.

The travels were significantly more than a regular Grand Tour completing a young man's education; however, we have little information as yet on the motivation besides the *Wanderlust* of the young Browne. However, we can make guesses of internal and external motives only: whether these were requests for information by representatives of the expanding British Empire (VÁRKONYI, 1972; COOK, 1999), economic calculations⁴ or pure scientific interest, remains hidden. This paper provides a few clues towards understanding the scientific background only.

A scientific trip to Lower Hungary

Shortly after his arrival in Vienna, in a letter of 26 November 1668 Edward Browne offered his services to HENRY OLDENBURG, secretary of the Royal Society of London, to wrote accounts on the gold mines at Kremnitz, on the silver mines in Brunswick, and other

² BOYLE, ROBERT (1627—1691) English-Irish chemist and natural philosopher, one of the founders of modern chemistry.

³ LOCKE, JOHN (1632—1704), English philosopher, established the epistemological foundations of modern science.

⁴ One of Boyle's relatives had interests in the vitriol trade.

natural curiosities in Germany, Bohemia, and Austria.⁵ The reply written in three weeks contained detailed instructions on observations to be made in the mining regions of Hungary. The questions probably derived from ROBERT BOYLE.⁶ The answers regarding the copper mine in Herregrund (Hungarian Úrvölgy, Slovakian Špania dolina) were published in the *Philosophical Transactions* (BROWNE, 1670). The curious statements in the article were supported by minerals from the mine, later repositied in the Museum of the Royal Society (Grew, 1681),⁷ and in private collections (WOODWARD, 1729). Specimens of the latter collection are preserved in the Sedgwick Museum of the University of Cambridge (KÁZMÉR, 1998; KÁZMÉR & PAPP, 1999).

BROWNE's papers in the *Philosophical Transactions* and his *Travels* (1673) are among the first publications on Hungary of scientific character in the modern sense. The diary is an important source of information on the living and travel conditions in Hungary during the last decades of Turkish occupation.

The mineral collector

Which minerals did Browne collect and why? Today's amateur collectors gather beautiful, colourful, shiny minerals. We cannot find such specimens in Browne's collection. Bone turquoise, gold ore, native copper and several types of copper ores, and vitriol were gathered and given to collectors back in Britain.

Among BROWNE's specimens – as reconstructed from printed catalogues (GREW, 1881; WOODWARD, 1729) and his letters – there were bone turquoise, gold ore, native copper and copper ores, vitriol, and specimens from the *Ciment*, a process yielding copper from acidic mine waters.

Seeing some of the original specimens in the Sedgwick Museum of Cambridge (PRICE, 1989; KÁZMÉR, 1998) one cannot avoid to think that Browne was not attracted to beautiful minerals. Rather, his choice of specimens reflects something else than aesthetic approach. Scientific significance was the leading motivation in picking specimens, as we can understand from Boyle's inquiries.

Native metals and ores are economically useful minerals. Vitriol (a ferrous or copper sulphate) is growing within mine adits during natural oxidation processes. Copper made by cementation is artefact, i.e. not mineral in the usual sense. Old iron was soaked in acidic mine water; the dissolved iron was substituted by copper. This process – the electrochemical background being unknown at the time – was considered as hard evidence for the possibility of transmutation, i.e. the alchemical process transforming elements into each other.

BROWNE's influence

The *Travels* brought considerable fame to EDWARD BROWNE. Dutch, German, and French translations plus reprinting five times in English appeared within ninety years of its first publication in 1673.

The opinion of literary circles, especially that of SAMUEL JOHNSON was somewhat reserved, comparing EDWARD's style to that of his father, Sir THOMAS BROWNE⁸, the well-known essayist and moralist. However, they failed to recognize the lasting value produced by a scientific mind.

ROBERT BOYLE, of course, relied on the results of his personal inquirer. His diaries⁹ clearly show the informations drawn from BROWNE's observations and inquiries, especially concerning copper and gold mining in Hungary, and on minerals quarried from or grown within the mines.

⁵EDWARD BROWNE to OLDENBURG, 26 November 1668. *In*: HALL & BOAS HALL (1968, V, 205—207).

⁶Oldenburg to E. Browne, 18 December 1668. *In*: HALL & BOAS HALL (1966, V, 261—263).

⁷E. Browne to Oldenburg, 4 February 1668/9. *In* Hall & Boas Hall (1966, V, 380—381).

⁸ Browne, Sir Thomas (1605—1682) English medical doctor and essayist. Best known for his *Religio Medici*.

⁹ ROBERT BOYLE (1627-91): Work-diary XXI ('Promiscuous Experiments, Observations & Notes'). <http://www.bbk.ac.uk/Boyle/workdiaries/wdframeindex.html>

Whether there is any long-lasting influence of BROWNE, will be the subject of further scientific inquiry. At least we know, that ROBERT TOWNSON¹⁰, another British traveller read his book before visiting the same region 120 years later¹¹.

Description of the copper mine at Herrengrund

BROWN, E. (1670): *An Accompt Given by Doctor Edward Brown, concerning the Copper-mine at Herrn-ground in Hungary*. – *Philosophical Transactions* 5/59, 1042–1044 [correctly 1942–1944], London.¹²

*Herrn-ground*¹³ is a little town, seated very high between two Hills, upon a part of land of the same name, an Hungarian mile distant from *Newsol*. In this town is the entrance into a large Copper-mine, very much digged.

I went in through a *Cuniculus*, called *Tach-stoln*¹⁴, and continued divers hours in the Mine, and visited many of the most remarkable places in it. The steep descents in this Mine are made by Ladders or Trees set upright, with deep notches on stayers cut in them to stay the foot upon. They are not troubled with water, the Mine lying high in the hill, so that the water may drain away; but they are molested with dust and damp.

The Veins of this Mine are large, many of them cumulate¹⁵, and the ore very rich; in an hundred pounds of Ore they ordinarily finde twenty pounds of Copper, sometimes 30, 40, half Copper, and even 60 in the hundred. Much of the Ore is joyn'd so fast to the rock, that tis separated with much difficulty. There are divers sorts of Ore, but the chief difference is between the Yellow and the Black: the Yellow is pure Coppe-ore: the Black contains also a proportion of Silver.

They find no *Quick-silver* here: the mother of the ore is yellow: and the Copper ore, heated and cast into water, maketh it becoe like that of some Sulphurous Baths.

They separate the Metal from the Ore with great difficulty.

The Ore commonly pases 14 times through the furnaces: sometimes it is burned, and other times melted; sometimes by it self, and sometimes mixt with other minerals and its own dross.

There are divers sorts of *Vitreol* found in this Mine; Green, Blew, Reddish, and White. There is also a Green earth or sediment of a green water, called *Berg-grun*¹⁶. There are likewise stones found of a beautiful green and blew colour, and one sort, on which *Turcoises* have been found; therefore called the *Mother* of the *Turcois*.

There are also two Springs of a Vitriolat water, which are affirm'd to turn into Copper¹⁷. They are called the Old and the New *Ziment*. These Springs lye deep in the Mine. The Iron is ordinarily left in the water 14 dayes. I here present you with some pieces of it, and with a Heart and a Chain, formerly Iron, now appearing to be Copper.¹⁸ Divers of these pieces I took out of the old-*Ziment*. They are hard within the water, and do not totally loose their figure, and if fall into powder, as you will perceive by them; they will easily melt, I have sent a piece melted without the addition of any other substance. They make handsome Cups and Vessels out of this Salt of Copper: I drank out of one of them, when I was at the *Verwalter*¹⁹

¹⁰ ROBERT TOWNSON (1762—1827) Scottish traveller and naturalist, author of *Travels in Hungary* (1797) szerzője (RÓZSA, 1999).

¹¹ See RÓZSA (this volume).

¹² Parts of this paper have been republished in the *Travels* (BROWNE, 1673, pp. 106—109). An alchemical discussion about transmutation of the *Travels* (p. 109) is missing in the scientific paper. There is a modern edition: [BROWNE, EDWARD] (1966): Concerning the Copper Mine at Herrngrund. In: HALL, A. R. & BOAS HALL, M. (eds.) (1966): *The Correspondence of H. Oldenbourg*. Vol. VI, pp. 588-590, Madison.

¹³ Hungarian *Úrvölgy*, German *Herrengrund*, Slovakian *Špania dolina*. Formerly significant mining colony northeast of Banská Bystrica.

¹⁴The original letter (HALL & BOAS HALL, 1966, VI, 588—589) uses the name *Tagstoln*, probably corrected by the German Oldenburg, editor of the *Philosophical Transactions to Tach-stoln*.

¹⁵abundant (HALL & BOAS HALL, 1966, VI, 588-590, footnote 4).

¹⁶ Originally *Berggrün* (HALL & BOAS HALL, 1966, VI, 589).

¹⁷Originally 'which turne Irone into Copper'.

¹⁸ It seems that OLDENBURG did not fully believe BROWNE's story.

¹⁹ Superintendent (HALL & BOAS HALL, 1966, VI, 589).

of *Hern-grownd* his house: It was gilded over, and had a rich piece of Silver-ore, fastned in the middle of it, and this Inscription grav'd on the outside,

*Eisen ware Ich, kupfer bin Ich,
Silber trag Ich, Gold bedeckt mich.*²⁰

i. e. Copper I am, but Iron was of old,
Silver I carry, cover'd am with Gold.

Minerals gathered at Herregrund

The best source of information on minerals gathered at Herregrund in the late 17th century is the catalogue of the Museum of the Royal Society (GREW, 1681). Another work providing numerous data on Hungarian minerals is the catalogue of a JOHN WOODWARD, a medical doctor of London (KÁZMÉR, 1998, KÁZMÉR & PAPP, 1999). His specimens are preserved – in original arrangement – in the Sedgwick Museum of the University of Cambridge (PRICE, 1989). Here the minerals from Herregrund are listed following the system of GREW (1681). WOODWARD's communications are inserted between GREW's paragraphs. Their identification with valid scientific names needs further, possibly instrumental studies.

„The MOTHER of the TURCOIS²¹, as i supposed. Found in the Mines of Herregrund in Hungary, and given by Dr. Edward Browne. Here are two Pieces. One of them, the greatest part, blew; with some places black. In which is also immersed a sort of small Sand-colour'd Stones, so hard as to scratch Glass. The other, hath also a mixture of some parts that are green. The Blew and Green, are both, and they only dissoluble upon the effusion of Acids.

The best of these Stones are the Blewest. (a) They have also this property; _c. to look blew by Day; (b) and Green by Candle-light. Many, faith Boetius²², have judg'd this to be reckon'd by Pliny, amongst Jaspers with the Name of Boreas. But either Pliny and the Ancients, or those that make that judgement of them, were generally mistaken. For this is a very soft Stone, and easily dissoluble with Ebullition, immediately upon the effusion of some, especially Nitrous Acids: and may be scraped with a Knife. SO that I am of Opinion; That 'tis nothing else but a sort of Aerugo in some measure petrify'd. Which also is further confirm'd in that it doth not only resemble that in Colour, but, being (as it is easily) burnt, is of the same Tast. So that it is no marvail, if this Stone, with Age and especially much worn and exposed to the Air, looseth the beauty of its colour. And that it may be restored to the same by Oil of Vitriol; which eateth off its faded Surface” (Grew, 1681, pp. 293—294).

Possibly another fragment of the same species was given to Woodward.

„A small piece of Bone, having its Surface of a green Colour, and its interior Parts of a blue; broke off from a much larger. That is throughout the same Colour. It seems to be part of the scutellated Bone of a Sturgeon; being flat, of a porous or cellular Constitution on one side, tho' the Cells be somewhat worn down, and flatted; and smooth on the other. 'Tis about 1/10 of an Inch in thickness, 3 Inches long, and 1 Inch and « broad. Taken up near Herregrundt in Hungary; colour'd by the Water of the rich Copper-Mines. Given me by Dr. Edward Brown, President of the College of Physicians. Those bodies that the Jewellers call Turcois-Stones, re no other than Pieces of Bones tinged blue by the Copper-Ore, amongst which they were lodg'd. These they cut, polish, and set in Rings. And indeed the same learned Gentleman, in his Travels, p. 68.²³ informs us, that in those very Copper-Mines of Herregrundt, are stones found of a beautiful green andblue Colour; and one sort upon which Turcoises have been found, and therefore call'd the Mother of the Turcois. By this I am the better enabled to apprehend an obscure Passage in P. Poterius's Pharm. Spagy. l. 2. c. 25. where he²⁴

²⁰ In-depth studies on the copper vessels made at Herregrund and their inscriptions are KIRNBAUER & STEISKAL-PAUR (1959), STEISKAL-PAUR (1979), and WEISS (2000).

²¹ Bone turquoise together with its matrix; turquoise matrix. Copper phosphate forming when copper solution flows through animal bones, e.g. of bats. (Sincere thanks are due to GÁBOR PAPP and TAMÁS WEISZBURG for their help in identifying the mineral and the process.)

²² BOETIUS, ANICIUS MANLIUS SEVERINUS (470—524) Roman scholar, Christian philosopher and statesman.

²³ Correctly: pp. 108—109.

²⁴ POTIER, PIERRE (POTERIUS) (16/17th century) medicus of the king of France, author of the famous pharmaceutical handbook *Pharmacopoeia Spagirica* (1625) szerzője.

says, that in the Cabinet of S. Cassiani del Pozzo at Rome, he saw Turcois-Stones made of Ebur-Fossile, exactly like the true natural Turcoises, agreeing with them in all respects, in Colour, in Hardness, and in Virtues".²⁵

Woodward's footnote: „Turchesios lapides, ex dicto Ebores factos veris, & naturalibus Turchinis Gemmis simillimos, atque in omnibus convenientes, Colore, Duritie, & Virtute praestantes" (WOODWARD, 1729, p. 28).²⁶

„GOLD ORE of HERNGRUNT, holding Silver. Given by Dr. Edward Brown. It consisteth of sparks of a shining Gold-colour, together with some Black ones, alternately immersed in a white and pretty hard Stone" (GREW, 1681, p. 322).

„Pure CAPILLARY COPPER from the Mine at Herngrunt. Given by Dr. Ed. Brown. 'Tis very ponderous, the several Styriae or Capillary parts but short, of a redish Golden colour, growing together almost like those of the little Stone-Moss" (GREW, 1681, p. 326).

„Another Piece of the same Species" (GREW, 1681, p. 322).

„Pure GRANULATED COPPER, from the Mine. Of a redish colour, mixed with a sad purple, and some green. Grows to a Stone, outwardl of a Liver-colour, within whitish; not very hard. This sort of Native Copper, by Chiocco, is call'd *Aeris Flow verus*" (GREW, 1681, p. 322).

„An Iron-Chain and Heart, at least, cover'd with a Crustof pure GRANULATED COPPER; by lying in one of the two Springs in the Copper-Mine call'd the Ziment in Hungary. Given with the next by Dr. Edward Brown" (GREW, 1681, p. 322).

„This was given me by Dr. Ed. Brown; and is what he in his Travels, pag. --- [109] calls iron turn'd into Copper; from a Spring near the Copper-Mines of Hern-Grunt in Hungary. The Brief of this Transaction is, these Springs, Rivulets, &c. that arise out of the Copper-Mines here, are impregnated with much Vitriol; in which there is also Copper dissolv'd. Indeed the Vitriol constitutes a kind of Menstruum. Upon the putting Iron in, that Menstruum preys upon it, and assumes the ferreous Parts into itself. At the same time it precipitates an equal proportion of the cupreous Parts; a thing common and well understood by Refiners, and all who have been conversant with Solutions in Aqua Fortis, and other like Menstrua" (WOODWARD, 1729, p. 50).

„Pure Native COPPER, both CAPILLARY, and GRANULATED, in one piece. The Capillary part, above two inches broad; and surrounded, like a Wood, by the other. Aldrovandus²⁷ hath a sort that is pointed, or at least angular; which Ambrosinus²⁸ calls *Aes nativum figurae pangoniae*" (GREW, 1681, p. 322).

„YELLOW COPPER-ORE, from the Mine at Herngrunt. Given by Dr. E. Brown. 'Tis of a redish yellow, mixed with some sparks of the colour of Gold, both without and within. It yields ordinarily 1/5th part Copper; sometimes 3/5ths or above half. See his Travails" (GREW, 1681, p. 327).

„Another piece of YELLOW COPPER ORE. Given by Mr. Oldenburg.²⁹ 'Tis immersed in small sparks in brown Stone; to which adhere some very green Flakes of the nature of Turcois " (GREW, 1681, p. 327).

„BLACK COPPER ORE, holding SILVER. There are some Grains of a dark Purple mixed with it. Given by Dr. Brown" (GREW, 1681, p. 327).

„BLEW VITRIOL, Native, and crystalliz'd, from the Copper-Mines of Herngrunt in Hungary. Given by Dr. Edward brown, together with the several species following" (GREW, 1681, p. 341).

„Native GREEN VITRIOL, mixed with some rays of a plae Blew; from the same place. With its astringent and sweetish Tasts, is joyn'd some Acritude. It grows to its own Ore, of a purplish ash-colour; and of a milder Tast" (GREW, 1681, p. 327).

„A parcel of the same Species, from the Copper-Mine of Herngrunt" (GREW, 1681, p. 327).

„Native VITRIOL of a pale Purple, and consisting of pointed Crystals. This also hath some Acritude. From the same Mine" (GREW, 1681, p. 327).

„Native WHITE VITRIOL. It grows in glossy Grains like Nitre grosly powder'd; and not without some Acritue. From the same place" (Grew, 1681, p. 327).

²⁵ PRICE's notice (1989): Only a small fragment remains. The author (KÁZMÉR, 1998) found a 4 mm wide, 7 mm long, 1 mm thick piece.

²⁶ Probably citation from POTERIUS.

²⁷ ALDROVANDI, ULISSE (1522—1605) medical doctor in Bologna, had a huge curiosity cabinet. The catalogue of minerals, rock and fossils therein title *Museum Metallicum* is an encyclopaedia of the mineral kingdom of nature.

²⁸ AMBROSINUS, BARTHOLOMAEUS (****) medical doctor in Bologna, published ALDROVANDI's *Musaeum Metallicum*.

²⁹ HENRY OLDENBURG (1615—1677), secretary of the *Royal Society*, editor and publisher of the Society's journal, the *Philosophical Transactions*. He published the scientific letters he received in a regularly appearing, printed format, thus establishing one of the first learned journals. Oldenburg never visited Hungary. This specimen might have been given by Browne or from any other major collectors of his time. For a review of contemporary gathering and exchange of minerals see KÁZMÉR (1998) and KÁZMÉR & PAPP (1999).

„A sort of Native VERDEGRIESE, from the Copper-Mines of Herngrundt. It consisteth of flat and parallel Plates, as in a Slate; of a blewish Green, yet not so blew, as the factitious. 'Tis also of a much milder Tast. It maketh a strong ebullition with Spirit of Nitre. These from the above-mention'd Person” (GREW, 1681, p. 327).

„Of the Nature of Vitriol, see several considerable Observations grounded on Experiment, in the same Transactions” (GREW, 1681, p. 342).

„Native Vitriol, saith Ambrosinus (c) given to the quantities of $\frac{1}{2}$ in any convenient vehicle, is a great Remedy in Germany and Hungary for the Plague. Blew Vitriol of excellent use against Venereal Ulcers. Both of this, and the Green, is made the Powder called Sympathetick; the Description whereof may be seen in papinius, and out of him in Wormius³⁰. I doubt not, but the Stiptick Liquors of Mr Lyster and Mr. Deny, are both made of Vitriol” (GREW, 1681, p. 342).

„BERG-GRUN; a green Earth, the sediment of a green Water³¹ in the Copper-Mine at Herngrundt. Given by Dr. Ed. Brown. 'Tis used by Painters” (GREW, 1681, p. 349).

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³⁰ WORM, OLE (1588–1654) Danish medical doctor and naturalist. Published a catalogue of his own curiosity cabinet, titled *Museum Wormianum* (1655).

³¹ Mud rich in copper (50–60 %), deposited in the Ciment.

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