

Moldavites from Austria

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Abstract—Several moldavites have been discovered in the northern part of Lower Austria. Tektites from two new locations (Altenburg and Radessen) have been analyzed. These new finds lend credibility to old reports about tektites from Lower Austria, some of which are associated with artefacts of prehistoric cultures. The new locations are situated between the Bohemian and Moravian parts of the moldavite strewn field, which is thus shown to extend further south than previously known. Most of the samples show clear indications of surface alterations by water and/or humic substances, and one sample shows signs of fluvial transport. The geological setting of the moldavite-bearing sediments is similar to the Czechoslovakian occurrences but is probably less disturbed. Chemically the samples show considerable variations even within one location. No unambiguous association with either the Bohemian or the Moravian group is evident either for the major or trace element abundances.

INTRODUCTION

MOLDAVITES OCCUR IN ONE of the world's four known tektite strewn fields (Australasian, North American, Czechoslovakian, and Ivory Coast strewn fields) and are named from their occurrence near the river Moldau in Southern Bohemia, Czechoslovakia. They are centimeter sized glass bodies of green color and show the typical shape and structure of tektites (Table 1). In the 18th and at the beginning of the 19th century they were called "bottle stones" ("Bouteillensteine") owing to their color. Scientific studies of these glasses started in 1787, when Josef Mayer described these strange green stones. The first chemical analysis was made in 1816 by the German chemist M. H. Klaproth. An extensive description of early studies on moldavites, as well as of theories regarding their origin, was given by Suess (1900).

The term "Czechoslovakian strewn field," in analogy to the geographical terms used for the other strewn fields, is not completely correct. Moldavites have also been found at several locations in the German Democratic Republic (GDR) (Rost *et al.*, 1979; Classen, 1982) near Dresden. Earlier, Bayer (1918, 1921) reported tektite fragments associated with paleolithic artefacts from Austria. No other complete moldavites have been reported from Austria, although some occurrences in Czechoslovakia are quite close to the Austrian border, and it would be logical to expect some tektites in the northern part of Austria. We report here on recently discovered moldavite specimens from Altenburg near Horn and Radessen (both in the Waldviertel region of Lower Austria, north of Vienna). In addition, we have performed chemical analyses of a moldavite which was reportedly found in the same region several decades ago and is kept at the Niederösterreichisches Landesmuseum.

HISTORY OF MOLDAVITES IN AUSTRIA

In his extensive treatment about the history of moldavite research at the beginning of this century, Suess (1900) does not mention any moldavite occurrences within the borders of present day Austria. Later, Sigmund (1912) described a single moldavite found near the village of Stainz, near Graz, in Styria, Austria. The object has the typical appearance of a moldavite, with surface features like grooves and pits and does not show any evidence of being worked by man. Recently this moldavite

has been analysed (Koeberl, 1985, 1986a); its chemistry is indistinguishable from moldavites from the Bohemian strewn field (Table 2). From this evidence it was concluded (Koeberl, 1986a), that the Stainz moldavite had been transported, most probably by prehistoric man. No other moldavites have been recovered from Styria.

Another interesting occurrence of moldavite glass in Austria was described by Bayer (1918). Several splinters of green moldavite glass were found together with the famous statuette "Venus von Willendorf" which has an age of about 30 000 years in Lower Austria. The worked tektites have been thought to be lost after the death of J. Bayer. Recently, a worked moldavite appeared in a private collection in the United States, which had been obtained from Miss N. Noriega, formerly the secretary of Otley Beyer, who may have obtained the moldavite splinters from Josef Bayer (J. A. O'Keefe, pers. comm., 1987). Microprobe analyses of the worked tektite piece showed that it is indeed a moldavite (J. A. O'Keefe, pers. comm., 1987). Thus it may be one of the Willendorf moldavite splinters.

Another worked piece of a moldavite, associated with prehistoric remains was found at the Gudenushöhle in the Waldviertel (Figs. 1, 2). Like in the Willendorf case, the moldavite had been worked by Paleolithic men.

Two more moldavites were found in Lower Austria earlier in this century. One 12 g piece, reportedly found at Mahrsdorf near Horn, had been divided into two pieces (one piece was cut like a gemstone) and is kept in the Niederösterreichisches Landesmuseum since 1931; another probable moldavite (weight 104 g) was reportedly found near Eggenburg and is kept in a local museum (Sigmund, 1937). In addition to analyses of the Mahrsdorf tektite, and following some initial reports (Brandstätter and Niedermayr, 1987), we report two new Austrian moldavite occurrences.

GEOGRAPHICAL DISTRIBUTION AND GEOLOGICAL SETTING OF NEW MOLDAVITES

Regional maps of the moldavite occurrences described in this paper are given in Figs. 1 and 2. In addition to the new Austrian tektite locations the prehistoric sites of Willendorf and the Gudenushöhle are indicated (Fig. 2). The moldavite occurrences Radessen, Altenburg and Mahrsdorf are situated relatively

TABLE 1. Morphology and microscopic characteristics of moldavites from Austria. B = bubble, L = lechatelierite, S = schlieren, +++ = very abundant, ++ = abundant, + = less abundant. AB: tektites from Altenburg, LM: tektite from Mahrsdorf, Rad: Radessen tektite.

Sample	mass (in g)	shape	surface	color	internal features
AB-a	0.74	elongated splash-form	corroded	light bottle green	B + L + S +
AB-b	0.82	elongated splash-form	corroded	light bottle green	B + L ++ S ++
AB-c	1.79	flat, triangular splash-form	strongly corroded	light bottle green	B +++ L +++ S +++
AB-d	10.83	drop-like splash-form	strongly corroded	very light bottle green	B +++ L + S ++
AB-e	0.39	drop-like splash-form	corroded	light bottle green	B ++ L + S ++
AB-f	1.11	flat splash-form with curved surface	strongly corroded	light bottle green	B +++ L ++ S ++
AB-g	0.88	flat splash-form	strongly corroded	light bottle green	B + L ++ S ++
AB-h	(*)	elongated splash-form		light bottle green	B ++ L ++ S ++
AB-i	10.20	elongated splash-form	ground and rounded	light bottle green	B ++ L + S +
LM	2.54 (**)	facetted stone emerald cut		bottle green	B ++ L ++ S ++
Rad	46.43	flat and rounded splash-form	slight corrosion and abrasion features	bottle green	B + L + S +

(*) complete specimen not available.

(**) complete specimen 12 g.

close to the Czechoslovakian border (15–30 km). In the E-W direction the Austrian tektite locations are situated between and south of the Moravian and the Bohemian subfields (Fig. 2) of the moldavite strewn field.

Two relatively large tektites were found in a field near Radessen (Fig. 2) in 1981. The tektites were recovered from a thin gravel layer overlying the crystalline basement. One of the Radessen tektites has been kept by the finder. According to the geological map of Austria (1984) the gravel layer belongs to the so-called Irnfritz-Radessen-Formation which most probably is of Miocene age.

The moldavites and Altenburg near Horn were found in a gravel pit in what appears to be an undisturbed setting. So far 12 specimens have been found. The gravel pit contains sands and gravel associated with discontinuous coal-bearing clay layers. The sediments show a typical fluvial deposition pattern and belong to the St. Marein-Freischling Formation (Tollmann, 1985). The surface of the uppermost gravel layer of this series is cemented by limonite and shows a reddish-brown color. The well-rounded gravels are overlain by a discontinuous sheet of subrounded to angular pebbles mixed with humic material. The tektites have been found in a small cut and fill structure of this

uppermost humic sediment layer. The geologic field evidence indicates that the tektites are in their original locations and have not been subject to redeposition.

It is evident that the tektite-bearing gravel layers (which also contain humus) differ from the underlying coarse clastic deposits. In comparison, the Bohemian and Moravian tektites in Czechoslovakia are found on top of the Mydlovary Formation, while Moravian moldavites from Znojmo are found in Pliocene sediments (Bouška, 1972).

The fluvial to lacustrine clays, sands, and gravels of the Oligocene to lower Miocene St. Marein-Freischling Formation most likely have their counterparts in the tektite-bearing sediments of the Mydlovary Formation in Southern Bohemia. The uppermost layer of the Mydlovary Formation probably corresponds to the sediments of the so-called Messener sands and clays and the Irnfritz-Radessener sand and gravel formation (Geologische Karte der Republik Österreich, 1984).

SAMPLE DESCRIPTIONS AND PETROGRAPHIC CHARACTERISTICS

A summary of the macroscopic and microscopic characteristics of the Austrian tektites is given in Table 1. The mor-

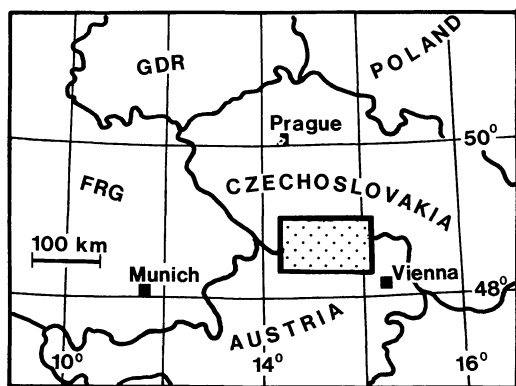


FIG. 1. Map of central Europe showing the area of the tektite locations (see Fig. 2) at the border between Austria and Czechoslovakia.

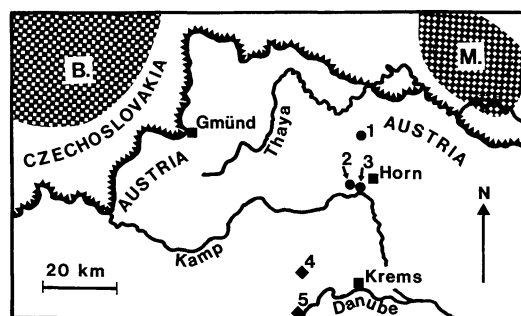


FIG. 2. The new tektite locations (filled circles) and tektites of pre-historic sites (filled diamonds). 1 Radessen; 2 Mahersdorf; 3 Altenburg; 4 Gudenushöhle; 5 Willendorf. Shaded areas indicate positions of the Bohemian (B.) and Moravian (M.) strewn fields.

phology of the samples and some internal features are shown in Figs. 3 and 4. All samples belong to the splash-form tektite variety. They are either of elongated and rounded or of flat and angular shape. All except one specimen (AB-i) show signs of more or less strong corrosion with delicate surface structures. These structures are clearly visible in Fig. 3a–d. The corrosion is assumed to result from etching of the glass due to interaction with water and humic substances in the soil environment. Specimen AB-i shows an abraded surface.

In transmitted light all tektites show a distinct pale green color. Sample AB-d is of very light pale green color, which agrees with the high SiO_2 content (see Geochemical Investigations section). All samples show abundant vesicles varying in size from less than a millimeter up to several millimeters (Fig. 4a,b). Many vesicles are elongated and have different orientation within one sample. The largest bubbles were found in specimen AB-d and are about 8 mm in diameter.

Lechatelierite is present in all samples and occurs mostly in finger-like structures which occasionally have long coiled tails (Fig. 4c). The location and structure of the lechatelierite in the glass is indicative of rapid and irregular glass flow during an early formation stage. Schlieren are present in all specimens and

are sometimes related to strain polarisation having the same orientation (Fig. 4d). No other mineral inclusions have been found in any of the samples, in accordance with previous observations on most moldavites (*e.g.*, Koeberl, 1986b; Bouška and Konta, 1987, and references therein).

GEOCHEMICAL INVESTIGATIONS

Of all the new moldavites recovered, seven have been analysed for major element composition by electron probe micro-analysis, using standard correction procedures. On each tektite about 10 individual spots, each with an area of approximately $10 \mu\text{m}^2$, were analysed in the scanning mode. Averages and standard deviations calculated from these individual analyses are given in Table 3.

Trace elements have been determined in small chips of four moldavites from the Altenburg location and of one from Radessen, using instrumental neutron activation analysis. INAA procedures, as well as reproducibility and precision, have been published before (Koeberl *et al.*, 1984, 1987) for most elements. Of the 37 trace elements determined, only upper limits have been obtained for three (Se, Br, Ir). The results are given in Table 4.

TABLE 2. Major element compositions (ranges and averages) for moldavites from the Bohemian and Moravian sub-strewn fields, the moldavite from Stainz (near Graz, Styria), and a Dresden (GDR) moldavite. All data in wt.%, and all Fe as FeO. The Bohemia range (Koeberl, 1986b) includes the Radomilice area. () = number of samples.

	Bohemia range (61)	Southern Bohemia average (89)	Radomilice area, average (11)	Moravia range (21)	Moravia average (37)	Stainz moldavite (1)	Dresden moldavite #8 (1)
SiO_2	75.5–85.1	80.0 ± 3.88	83.2 ± 2.25	74.9–81.4	79.3 ± 1.93	80.42	79.15
Al_2O_3	7.32–11.4	9.95 ± 0.66	8.04 ± 0.86	9.44–13.8	10.8 ± 1.19	9.38	10.16
FeO	1.08–2.93	1.81 ± 0.28	1.36 ± 0.39	1.72–3.50	2.16 ± 0.48	1.30	1.85
MgO	1.34–2.74	1.97 ± 0.39	1.89 ± 0.61	1.13–2.06	1.53 ± 0.38	1.58	1.67
CaO	1.21–3.96	2.71 ± 0.72	2.23 ± 0.80	0.95–3.17	1.89 ± 0.73	2.95	2.50
Na_2O	0.20–0.89	0.46 ± 0.12	0.30 ± 0.13	0.40–1.08	0.55 ± 0.17	0.22	0.49
K_2O	2.23–3.81	3.39 ± 0.28	2.50 ± 0.48	2.83–3.81	3.35 ± 0.27	3.04	3.47
TiO_2	0.24–0.74	0.33 ± 0.06	0.33 ± 0.15	0.31–1.40	0.39 ± 0.10	0.23	0.24
Reference:	(1)	(2)	(2)	(1)	(2)	(3)	(4)

(1) Koeberl (1986b).

(2) Bouška and Konta (1987).

(3) Koeberl (1986a).

(4) Rost *et al.* (1979).

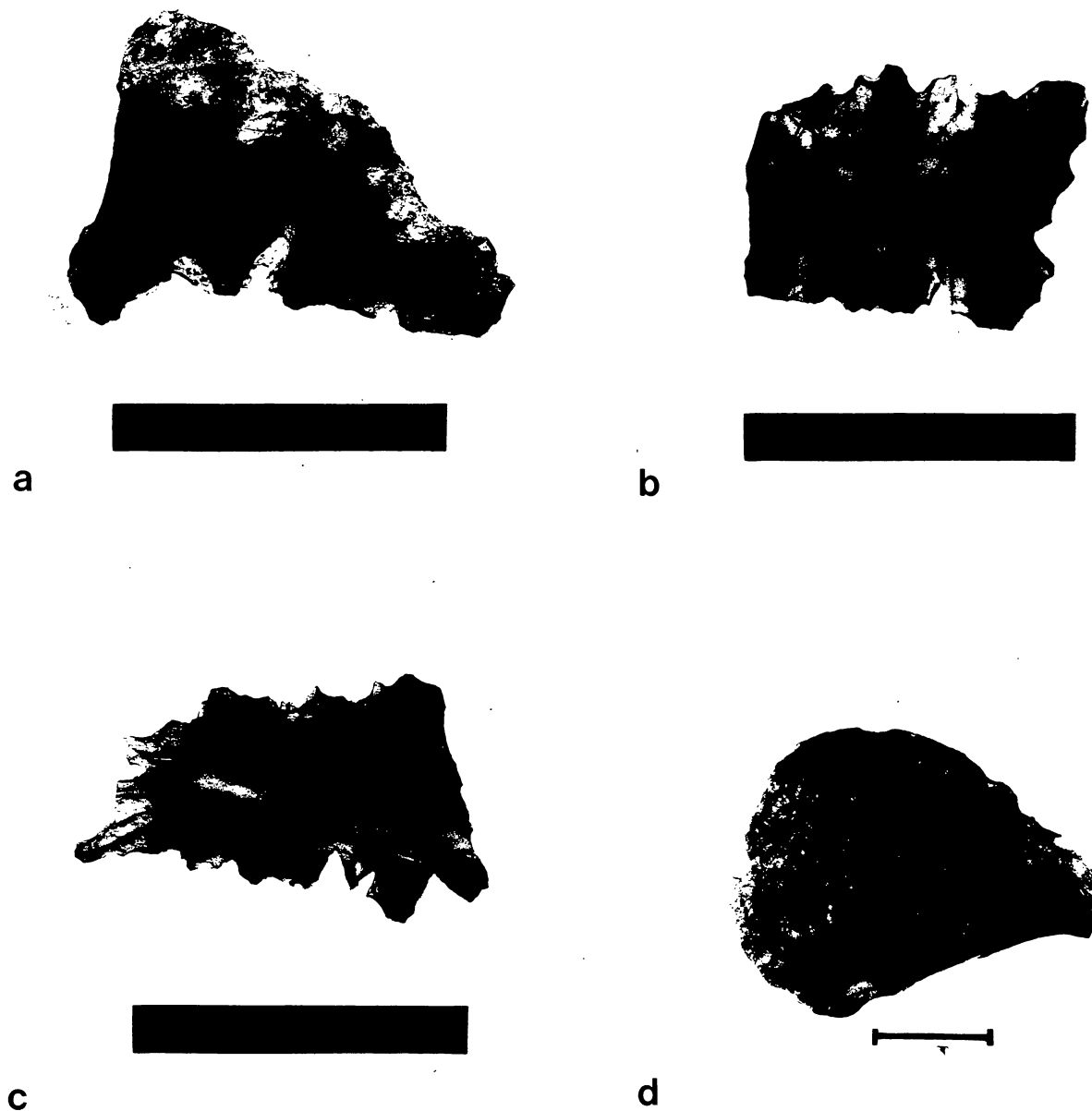


FIG. 3. Morphology of some of the new Austrian tektites. Fig. 3a–c: Altenburg location, Fig. 3d: Radessen location. a) sample AB-c; b) sample AB-f; c) sample AB-g; d) sample Radessen Bar scale = 2 cm.

DISCUSSION

The recent findings of tektites in a gravel pit near Altenburg at Horn are well documented and from their locations within the sediment it seems obvious that they were naturally deposited. The Altenburg findings show (i) that moldavites occur in geological units in Austria comparable to their counterparts in Czechoslovakia, and (ii) indicate that the tektite location at Mahrsersdorf is most probably genuine.

From the correspondence between the Czechoslovakian and Austrian sand and gravel sediments it follows that the tektites

from Radessen and Altenburg are most probably autochthonous components of an uppermost Miocene or even Pliocene gravel sheet. Most samples do not show any indication of transport.

All tektites have been recovered from a rather small area in Lower Austria. Thus, if they have not been redeposited, we would expect only limited chemical variations between the individual specimens, since the tektite chemistry at other strewn fields (such as the Australasian strewn field) does not show large variations within individual locations (Koeberl, 1986b, and references therein). The Austrian data tell a different story. Three of the samples are quite similar (AB-a, AB-b, and AB-h), but

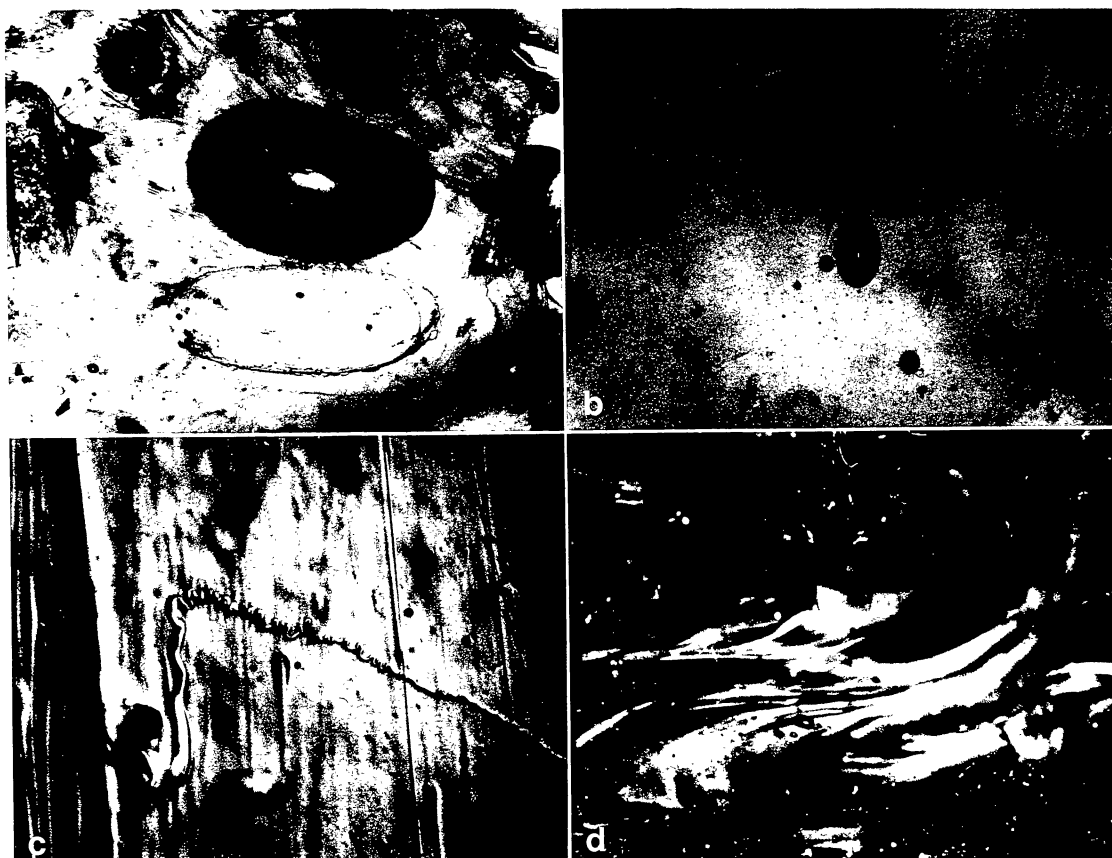


FIG. 4. Typical internal features of the Austrian tektites investigated. a) one of the large (8 mm diameter) vesicles in sample AB-d. Long dimension 18 mm. b) small bubbles (the larger ones being elongated) in sample AB-f. Long dimension 6 mm. c) lechatelierite inclusion in sample AB-f, showing a long spiral-shaped tail, which probably resulted in a flow during the liquid phase. Long dimension 3.5 mm. d) strain polarization features associated with schlieren of similar orientation. Crossed nicols, long dimension 12 mm.

one (AB-d) is strikingly different. It shows very high SiO_2 and very low FeO contents, as well as a very high $\text{K}_2\text{O}/\text{Na}_2\text{O}$ ratio (13.8). The K_2O content of samples AB-a and AB-b is unusually high—higher than the range obtained from 82 samples from the Bohemian and Moravian strewn fields (Table 2). Due to the high K_2O but normal Na_2O content, these samples also have an unusually high $\text{K}_2\text{O}/\text{Na}_2\text{O}$ ratio. The average ratio in normal Southern Bohemian moldavites is 7.4, here it is 10.6 and 9.5, respectively.

Moldavite AB-h is similar to AB-a and AB-b except for a slightly lower CaO content, which is not unusual since Ca is one of the most variable elements in moldavites. Sample AB-i

has a composition much like an average Bohemian moldavite, but again with slightly lower CaO and MgO contents. SiO_2 is higher than in all other samples except AB-d. Since the K_2O content of this sample is not unusually high, the $\text{K}_2\text{O}/\text{Na}_2\text{O}$ ratio is normal. The LM moldavite is similar to sample AB-h, and since the exact location of that sample is not known it is quite possible that it was found either at the same location or close to it.

The Radessen moldavite, on the other hand, is definitely different from all the Altenburg samples, including AB-d. It has a slightly higher silica content, higher FeO , but lower MgO and CaO . The $\text{K}_2\text{O}/\text{Na}_2\text{O}$ ratio (7.3) is also lower than in the other

TABLE 3. Major element analyses of Austrian moldavites, obtained by electron probe microanalysis. All data in wt.%, total Fe as FeO .

	AB-a	AB-b	AB-d	AB-h	AB-i	LM	Rad
SiO_2	78.4 ± 0.35	77.8 ± 0.44	85.1 ± 1.10	78.1 ± 1.12	80.6 ± 0.71	78.7 ± 0.64	79.4 ± 1.09
TiO_2	0.29 ± 0.01	0.31 ± 0.03	0.24 ± 0.02	0.32 ± 0.02	0.31 ± 0.02	0.31 ± 0.01	0.35 ± 0.02
Al_2O_3	9.80 ± 0.22	10.1 ± 0.10	8.10 ± 0.48	10.6 ± 0.32	9.60 ± 0.19	10.0 ± 0.16	10.5 ± 0.24
FeO	1.60 ± 0.07	1.61 ± 0.04	1.02 ± 0.12	1.61 ± 0.13	1.63 ± 0.06	1.56 ± 0.03	1.78 ± 0.07
MnO	0.08 ± 0.02	0.07 ± 0.03	0.04 ± 0.03	0.07 ± 0.03	0.04 ± 0.02	0.08 ± 0.03	0.03 ± 0.02
MgO	2.03 ± 0.08	2.02 ± 0.07	1.25 ± 0.11	2.10 ± 0.32	1.35 ± 0.03	2.01 ± 0.34	1.25 ± 0.07
CaO	3.20 ± 0.10	3.30 ± 0.07	1.46 ± 0.17	2.52 ± 0.36	1.96 ± 0.04	2.72 ± 0.58	1.73 ± 0.10
Na_2O	0.36 ± 0.03	0.41 ± 0.03	0.19 ± 0.02	0.42 ± 0.05	0.49 ± 0.03	0.36 ± 0.04	0.49 ± 0.05
K_2O	3.80 ± 0.04	3.90 ± 0.05	2.62 ± 0.09	3.50 ± 0.08	3.40 ± 0.21	3.60 ± 0.08	3.60 ± 0.05

TABLE 4. Trace element data for four moldavite samples from the Altenburg location, and one Radessen tektite obtained by neutron activation analysis. All data in ppm.

Element	AB-a	AB-b	AB-d	AB-i	Rad*
Sc	5.40	5.76	4.72	4.44	5.4
Cr	34	39	23.7	24	32
Mn	651	690	560	410	344
Co	7.50	7.55	5.35	5.18	6.00
Ni	<80	<50	18	<30	<20
Zn				<20	14
Ga	9	7.2	3.1	5.0	4.87
As	<0.5	<0.2	0.1	0.2	
Se	<1	<1	<0.5	<1	<1
Br	<1	<1	<0.7	0.1	<0.2
Rb	160	170	127	136	146
Sr	110	190	108	140	126
Zr	310	260	310	180	205
Sb	0.9	1.0	0.52	0.4	<0.1
Cs	14.6	15.6	12.7	16.3	16.2
Ba	640	672	480	780	770
La	25.7	28.9	23.7	24.0	30.8
Ce	64.3	69.5	59.1	51.9	58.1
Pr		7.2	5.88		7.3
Nd	29.0	29.7	23.8	26.0	27.3
Sm	4.90	5.77	4.75	4.6	5.35
Eu	1.09	1.10	0.86	0.83	1.03
Gd	4.3	5.6	4.6	3.4	3.3
Tb	0.70	0.93	0.75	0.62	0.65
Dy	3.80	5.5	4.5	3.40	3.43
Ho			0.9		0.79
Er				1.9	2.6
Tm	0.32	0.44	0.35	0.27	0.44
Yb	2.35	2.69	2.06	1.79	1.96
Lu	0.32	0.36	0.31	0.28	0.28
Hf	5	8	8.15	6.1	6.35
Ta	0.68	1.17	0.86	0.40	0.71
W	1.0	0.6	0.35	0.82	0.56
Ir	<0.001	<0.001	<0.0005	<0.001	<0.003
Au	0.010	0.012	0.009	0.02	0.011
Th	11.7	12.6	10.6	9.7	10.7
U	2.48	2.47	2.74	2.63	2.12

* The Radessen sample was analysed at the MPI in Mainz, FRG.

samples. The Radessen moldavite is, from the major element composition, similar to the average composition of the Moravian subgroup.

Figure 5 shows several examples of oxide ratio plots, and although the distinction is not clear-cut it can be seen that Moravian and Bohemian moldavites form more or less distinct subfields. Thus it should be possible to distinguish moldavites from unknown localities by their position in such a diagram. This approach supports the view that the Stainz moldavite was transported from the Bohemian subfield.

The interesting result for the Austrian tektites is that they show a spread in chemical composition. The Radessen moldavite plots clearly within the Moravian field, while most of the Altenburg samples lie within the Bohemian field. Again sample AB-d is different and plots between the bulk of the Altenburg samples and the Radessen sample, putting it in the transition region between the bulk of the Moravian and the Bohemian fields. Since the moldavites in question were found in undisturbed locations, we assume that these are close to the places where they fell. This indicates that the chemical composition of moldavites within a rather small area may vary considerably.

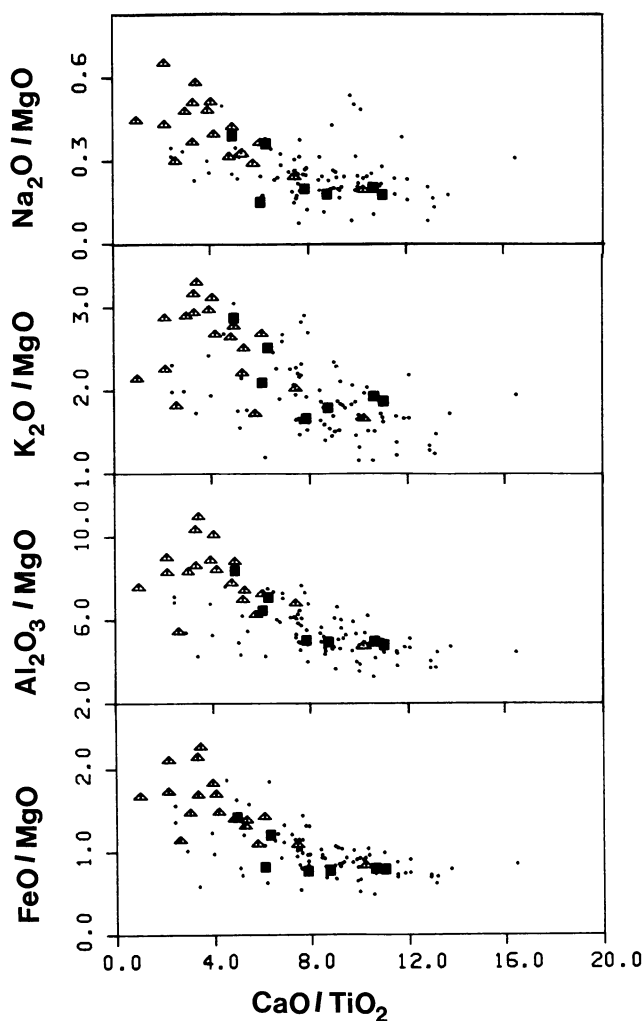


FIG. 5. Plot of oxide weight percent ratios (after Delano and Lindsley, 1982; Delano *et al.*, 1982). Dots: Bohemian moldavites; triangles: Moravian moldavites; squares: new Austrian tektites. Almost all available modern moldavite analyses have been used (Bouška and Konta, 1987; v.Engelhardt, pers. comm., 1987; v.Engelhardt *et al.*, 1987; and references in Koeberl 1986b). Although interlaboratory differences may blur the distribution to some extent it is clear that there is no complete separation between the two major subfields. It is still obvious, however, that there are parts of the diagram populated predominantly by Bohemian or Moravian tektites. The square that is the most to the left and which plots higher than the other Austrian tektites (amongst the triangles) is the Radessen tektite. Thus, while the other Austrian tektites appear to be more closely associated with the Bohemian subgroup, the Radessen sample seems to be related to the Moravian group.

Furthermore, there are some differences even in tektites from the Czechoslovakian strewn fields, such as the extremely high K_2O content. The major element chemistry of sample AB-d looks even more like a sample from the Radomilice area (some authors prefer to subdivide the Bohemian strewn field in a Southern Bohemian area and a Radomilice area (*e.g.*, Bouška and Konta, 1987)—they typically show high SiO_2 contents and lower Al_2O_3 , K_2O , Na_2O , and FeO).

Trace element contents confirm the view that there are chemical variations present among the new samples. Samples AB-a and AB-b show an almost identical trace element chemistry, in

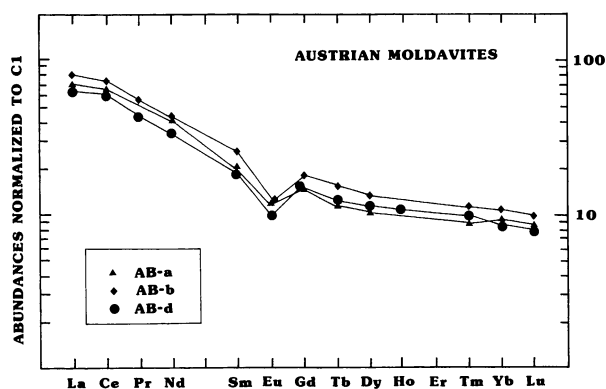


FIG. 6. Chondrite normalized rare earth element pattern for three of the five samples analyzed for trace elements. Some differences between samples AB-a and AB-b on one side and sample AB-d on the other side are visible, which are unlikely to result from dilution with silica. The pattern is characteristic of recent upper crustal sediments (Taylor and McLennan, 1985), in agreement with results obtained for other moldavites.

agreement with trace element compositions reported for Czechoslovakian moldavites (Bouška *et al.*, 1973; Bouška and Řanda, 1976; Luft, 1983; Koeberl, 1985, 1986a,b; Koeberl *et al.*, 1985; Bouška and Konta, 1987; v.Engelhardt *et al.*, 1987). No clear connection to any of the other moldavite sub-strewn fields is evident, if averages of trace element compositions (*e.g.*, Bouška and Konta, 1987, or v.Engelhardt *et al.*, 1987) are taken. A REE plot (Fig. 6) shows the difference between samples AB-a, AB-b and AB-d quite well. From this plot it is also clear that simple dilution with silica may not lead to the observed pattern, since there is almost no difference in the HREE region.

Cs and Ba in AB-i are more abundant than in any other AB-sample, while the Mn content is lower. Thus the trace element abundances in AB-i and AB-h are comparable to the Radessen sample. Table 3 shows also that the major element composition of the Radessen sample is close to the AB-i sample. This shows that there is no clear compositional difference between samples from the Altenburg and the Radessen locations.

CONCLUSIONS

The discovery of moldavites in Austria shows that the moldavite tektite strewn field is not confined to Czechoslovakia, but extends further south than previous assumed. Earlier reports of tektites found in northern Lower Austria thus gain credibility.

The new tektite locations are situated between and south of the Bohemian and the Moravian subfields of the moldavite strewn field. The appearance and surface structure of the new tektites suggest that at least one of them was transported by fluvial action, while the others have been subject to corrosion by water and humic substances while remaining more or less *in situ*.

The chemical data show a close similarity with other moldavites, although no clear association of tektites from either one of the Austrian locations with the Bohemian or Moravian group is evident. The composition of tektites within one location (namely the Altenburg site) is not uniform, but shows considerable variations. Two of the Altenburg samples have K_2O contents that are higher than other known samples. Major and trace

element contents of two of the Altenburg samples are similar to the Radessen sample, showing that there are considerable chemical variations in an otherwise geographically rather limited occurrence. Thus discovery of tektites in Austria is not in contradiction with a Ries origin, contrary to what had been claimed for some Austrian and the Dresden moldavites (O'Keefe, 1983).

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