TABLE 4

Chemical composition of glass bombs (Fladen) from suevite, collected at 9 different localities in the Ries basin (Amerbach, Aufhausen, Aumühle, Bollstadt, Doosweiher, Fünfstetten, Heerhof, Otting, Schmähingen).

	9 unrecrystallized glass bombs		17 recrystallized glass bombs	
	Average composition	Standard deviation	Average composition	Standard deviation
SiO_2	63.54	1.03	64.04	1.15
TiO_2	0.81	0.08	0.78	0.10
Al_2O_3	15.10	0.43	15.28	0.80
Fe_2O_3	0.99	0.19	1.42	0.72
FeO	3.75	0.19	2.39	1.26
MnO	0.10	0.01	0.08	0.03
MgO	2.71	0.19	1.71	0.92
CaO	3.45	0.34	3.98	0.54
Na_2O	2.86	0.29	3.59	0.68
K_2O	3.71	0.16	3.50	0.76
P_2O_5	0.36	0.12	0.32	0.08
H_2O^+	2.73	0.30	2.72	1.05
CO_2	0.37	0.22	0.33	0.19
Total	100.48	—	100.14	—
Fe^{2+}/total Fe	0.81	—	0.65	—

consists of fine schlieren which differ in refractive index and in color. The structure reflects the heterogeneous nature of the parent rock, the intense movement of the melt, and the short duration of the molten state (Fig. 7).

The chemical composition of the *Fladen* is very uniform. Table 4 shows the average chemical composition of 9 unrecrystallized and 17 recrystallized *Fladen*, collected at 9 different localities around the Ries basin. As can be seen from the standard deviations, the scattering is relatively low. The composition of the *Fladen* is consistent with the assumption that they were produced by melting of the granitic basement rocks. Their chemical composition differs appreciably from the composition of *Moldavite* tektites, and theories which derive the Moldavites from melt produced by the Ries impact event have to explain this discrepancy (Engelhardt and Hörz, 1965). The *Fladen* differ in their cooling histories. There are rapidly chilled *Fladen* which contain clear, undevitrified glass; specimens of more slowly cooled *Fladen* show different types of devitrification. Cristobalite, feldspar, and pyroxene are the main devitrification products; they crystallized after movement in the melt had ceased. This conclusion follows from the observations that orientation of the new crystals is not affected by the flow pattern of the glass and that there are no parallel arrangements of elongate crystals of the type so familiar in lava flows. Furthermore, it is certain that devitrification took place after deposition of the suevite breccia, because it can be seen that, in

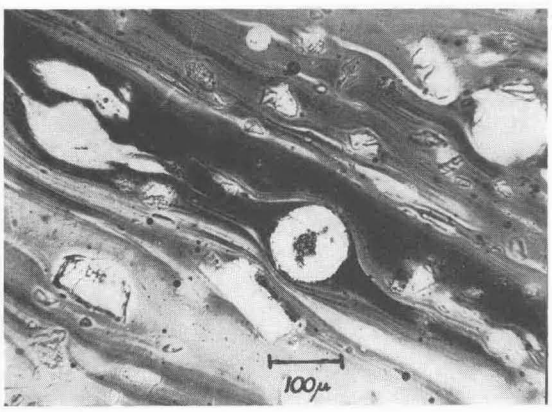

Fig. 7. Unrecrystallized molten glass, from the suevite at Otting. Schlieren, circular vesicles, angular mineral fragments, and fused silica (lechatelierite) (light-colored elongate areas in upper left) are all present.

some suevite quarries, the lowest, rapidly cooled layer of suevite contains only unrecrystallized glasses, whereas higher in the suevite, all the *Fladen* are devitrified. In the quarry of Otting, for instance, the chilled basal layer is about 1 m thick. Chilled layers with unrecrystallized glasses at the bottom and the top of suevite have also been found in the bore hole at Wörnitzostheim (Förstner, 1967).

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