

THE DISTRIBUTION OF LAACHER SEE ASH WEST OF THE EIFEL REGION

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ABSTRACT

Volcanic grain percentages in heavy-mineral concentrates of local colluvial deposits in Luxembourg and surrounding areas have been used to trace the dispersal of an ash deposit of Allerød age characterised by an association of brown amphibole, pyroxene and sphene. Remnants of the ash fall were detected at distances of more than 300 km southwest of the Laacher See eruption centre. As Allerød ashes previously have been found at similar distances east of this centre, it is evident that the dominant wind direction during this geological interstade cannot be reconstructed from the distribution of ashes produced by short-lived eruptions.

INTRODUCTION

Since Frechen's study of ash beds in peat bogs in central and southern Germany, it has been known that ejecta from the Allerød eruptions of the Laacher See were carried by westerly winds over distances from their source area in the eastern Eifel, exceeding 300 km (Frechen, 1953). The heavy-mineral association of this ash is dominated by augite, with brown amphibole, apatite and other minerals as minor constituents.

Van Andel (1950) reported the presence of volcanic minerals in deposits west of the Eifel region. Since then it has been established by a large number of authors that these minerals occur all over Luxembourg (for literature, see Lucius, 1961) as well as in southeastern Belgium (Gullentops, 1952, Tavernier and Laruelle, 1952). Most authors have attributed this volcanic material to a Laacher See eruption of Allerød age, although here brown amphibole and sphene are much more important constituents than in the deposits east of the Eifel region.

Palynological investigations of peat bogs containing thin bands of volcanic material in the western Eifel and in the Semois valley largely confirmed the hypotheses of earlier authors. It was found that a) the ash is derived from the

Laacher See where pyroclastic deposits with a similar brown amphibole-pyroxene-sphene association are present, b) the eruptions occurred during the Allerød, and c) the ejecta were blown towards the southwest (Hulshof et al., 1968; Jungerius et al., 1968). Some of the results of these investigations were challenged by Erlenkeuser et al. (1972) but until it has not been definitely established that the same ash intercalations are concerned, a discussion of the arguments of these authors serves little purpose.

In the area west of the Eifel volcanic minerals have been used for dating terraces and paleosols (Schmitz, 1957; Juvigné, 1973), for distinguishing pre-Allerød and post-Allerød alluvial and slope deposits (Jungerius, 1958) and also for estimating the effect of Holocene soil erosion from the amount of volcanic minerals remaining in the surface soil (Jungerius and Mùcher, 1970).

Volcanic material which has been deposited over a large area within a short time interval may constitute a valuable stratigraphic marker (Frechen, 1959). Until now only one undisturbed occurrence of the ash fall west of the Eifel region has been reported (Hulshof et al, 1968). The present paper reports the results of investigations carried out to obtain more information on the distribution of the volcanic components west of the Eifel, in order to delineate more accurately the area where the ash layer can be used as a stratigraphic marker.

PROCEDURE

Samples were taken at 10 or 20 km intervals along roads extending from the City of Luxembourg towards the 3 main compass directions N, W and S, and towards the NE, SE and SW. The samples were derived from local colluvial deposits because these materials are considered to be the result of local soil erosion and consequently offer the maximum probability of containing remnants of the former ash cover. In each sample the percentage of volcanic mineral grains in the heavy-mineral concentrates of 50 to 500 micron was determined. The results are shown in Table 1 and in Fig. 1.

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Fig. 1 Map showing lines and sites of sampling. Heavy dots mark locations where the heavy fraction of samples derived from local colluvium contains more than 10% volcanic minerals.

DISCUSSION

As the content and ratios of volcanic mineral species in colluvial deposits depends not only on the amounts that were deposited at the time of eruption but also on a number of local conditions such as the rate of soil erosion on the higher grounds surrounding the colluvial site and on weathering, it is not surprising to find that the percentages and ratios fluctuate widely in adjacent samples (Table 1).

The impression has been gained, especially from the sporadic observation of orthopyroxene, that material from an older ash cover may have contributed locally to the volcanic-mineral content. This impression has been confirmed by the recent work of Juvigné. In the Ourthe valley near Tilff, about 5 km south of Liège, this author found the Allerød volcanic minerals in alluvial deposits but another volcanic association characterised by enstatite in the lowest terrace (Juvigné, 1973). Due the west of Maastricht he

Sample line	N				NE				S				SW				W				ZO								
	Content %	brown amphibole	pyroxene	sphene	total	Content %	brown amphibole	pyroxene	sphene	total	Content %	brown amphibole	pyroxene	sphene	total	Content %	brown amphibole	pyroxene	sphene	total	Content %	brown amphibole	pyroxene	sphene	total				
Sample number					Sample number					Sample number					Sample number						Sample number								
1	36	10	12	58	1	5	7	6	18	1	23	19	7	49	1	24	6	15	45	1	8	43	4	55	1	10	9	9	28
2	27	11	11	49	2	2	4	4	10	2	6	6	5	17	2	1	1	1	3	2	11	1	7	19	2	40	16	14	70
3	12	8	1	21	3	11	15	10	36	3	9	7	5	21	3	2	2	-	4	3	-	1	-	1	3	34	12	12	58
4	2	2	1	5	4	17	34	14	65	4	21	16	6	43	4	2	50	1	53	4	3	-	1	4	4	24	8	8	40
5	1	1	1	3	5	3	48	2	53	5	19	6	2	27	5	1	86	2	89	5	6	-	3	9	5	18	9	4	31
6	-	1	1	2	6	9	34	9	52	6	9	6	4	19	6	8	10	1	19	6	1	-	3	4					
7	2	21	1	24	7	28	8	9	45	7	42	32	13	87	7	21	21	14	56	7	1	-	1	2					
8	-	3	-	3	8	35	19	12	66	8	34	16	9	59	8	14	26	7	47	8	19	4	2	25					
9	1	1	-	2	9	18	71	8	97	9	4	11	4	19	9	11	3	13	27	9	21	7	2	30					
10	4	2	1	7	10	60	25	14	99	10	1	5	-	6	10	6	7	1	14	10	2	9	2	13					
					11	32	56	10	98						11	-	1	2	3	11	4	1	4	9					
					12	28	61	7	96						12	-	2	-	2	12	2	-	1	3					
					13	9	91	-	100						13	17	19	6	42										
					14	18	65	7	90						14	38	24	6	68										
															15	9	20	3	32										

TABLE 1
Percentages of volcanic minerals in the heavy fraction of samples derived from local colluvium. For the location of sampling lines and sites, see Fig. 1.

discovered (Juvigné, 1974) the latter assemblage in the material of a fossil soil (Sol de Warneton). In the area of the Eifel particularly, the contamination of the brown amphibole-pyroxene-sphene association from the Allerød at the surface with amongst other minerals the clinopyroxene from older erupted material is evident from the often very high pyroxene contents.

It was found that Luxembourg occupies a more or less central position in the observed distribution pattern of the volcanic materials. North of this country the volcanic mineral content drops below 10% of the heavy-mineral fraction and remains at this low level, with the exception of a pyroxene peak in the same area where Juvigné found traces of an older eruption. A similar drop in the volcanic mineral content was found near Nancy along the sample line towards the south, whereas the boundary of the ash cover west of the City of Luxembourg was apparently situated not far beyond Bouillon.

The largest extension was found towards the southeast. Where sampling was stopped at a distance of less than 100 km from Paris, and more than 300 km from the Laacher See, the content of volcanic minerals was still over 30 per cent of the heavy-mineral fraction.

From the present data and the earlier findings of Frechen (1953) it may be inferred that reconstructed distribution patterns of volcanic ashes produced by short-lived eruptions are not always suitable for the reconstruction of the dominant wind direction during geological spaces of time.

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