

VOLCANOGENIC ROCKS IN THE CARBONIFEROUS OF CENTRAL AND WESTERN BOHEMIA.

by

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ABSTRACT: In an ideal section through the sediments of the continental Carboniferous of Central Bohemia, at least 26 vertically distant horizons and groups of horizons of volcanogenic rocks occur. They can be divided into two sets, each of which shows maximum volcanic activity in its lower part. In the earlier in addition to tuffs and tuffites, various Upper-Carboniferous igneous rocks are sporadically present. The distribution and increase of thickness of the volcanogenic rocks in the Radnice Member (see Table 1) leads to the conclusion that in the latter the volcanic material was supplied from the sources lying approx. south-west of Kladno, and from north-western Bohemia (from the Ohře-River region). In the Nýřany Member, the volcanic action developed more intensively in western Bohemia, while in the Týnec Formation, this action shifted to the east, into the surroundings of the Carboniferous underlying the Cretaceous (Sub-Cretaceous Basin), east of the river Vltava. It seems that this action continued here also beneath the subsequent younger sediments. The stratigraphically most persistent and most widespread horizon composed of volcanogenic material, is that of the so-called "kamínek" (rock of the Kounov Member). This horizon occurs practically in all places where the sediments with the Kounov seam or its analogue are present, except for western Bohemia, where it is not necessarily developed everywhere. Especially in the Sub-Cretaceous Basin and in the Kladno area, volcanogenic sediments are concentrated in the youngest (Lině) Formation.

The Carboniferous of central and western Bohemia fills three rather extensive continental basins — from the west to the east: the Plzeň Basin, the Kladno-Rakovník Basin, and the Sub-Cretaceous Basin (fig. 4). These are bordered by a number of minor or major isolated occurrences of Carboniferous sediments which for a time may have been linked with these basins. Similarly, the three basins were temporarily linked with each other. Thus, analogous sediments occur throughout this area and the same problems are encountered with the basins.

The present state of investigation of these basins permits a summary of the knowledge on the representation and character of the

volcanogenic rocks occurring in the above-mentioned sediments. Some of these rocks, often clearly differing from the common Carboniferous sediments, were exploited due to their special character, their immediate proximity to the seam mined or even the presence within the seam, to their stratigraphic persistence and sometimes also because of the fossils appearing in amounts which seemed striking not only to geologists and palaeontologists but also miners. W. PETRASCHECK (1925) was the first to begin their systematic investigation. A. ORLOV who in 1941-1945 published a number of papers was distinguished by his detailed petrographical investigation of volcanogenic rocks of the Radnice Member (Tab. 1). Recently, especially J. MAŠEK (1963, 1966, 1967, 1973, etc.) and V. SKOČEK (1965, 1967, 1970, etc.) have been engaged in the systematic study

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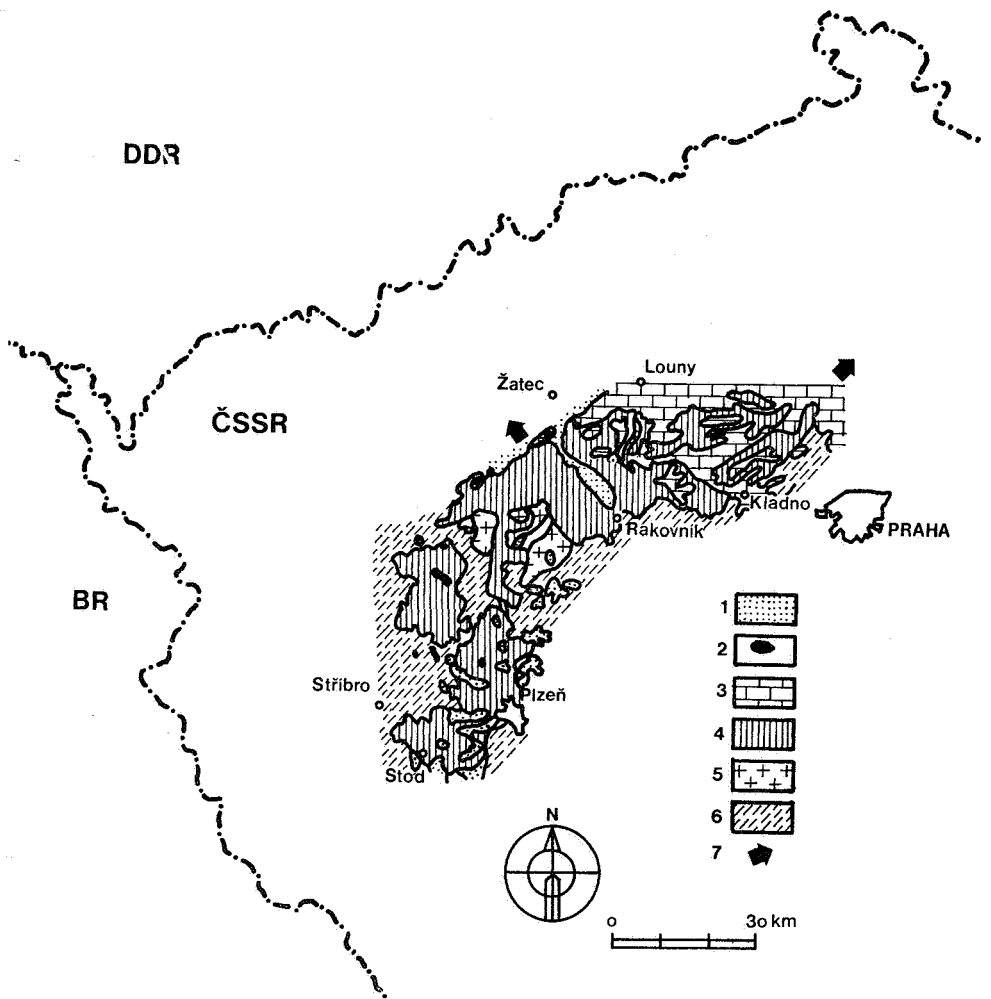


Fig. 1. Geological sketch map of the uncovered Carboniferous of Central and Western Bohemia, and the rocks in its vicinity.

1 — Upper Tertiary sediments, 2 — Upper Tertiary igneous rocks, 3 — Upper Cretaceous sediments, 4 — Upper Carboniferous sediments, 5 — Variscan and other igneous rocks, 6 — weakly metamorphosed Proterozoic rocks, 7 — distribution trends of the Carboniferous underlying the Cretaceous and Tertiary rocks.

of the volcanogenic rocks in all formations of the area under consideration.

The rocks of the volcanogenic macrofacies compose a small part only of the whole Upper Carboniferous. The sediments of the Carboniferous in central and western Bohemia are continental throughout, being developed especially in fluvial, lacustrine, or peat-bog- etc. macrofacies. When the representation of volcanogenic rocks is

followed up here horizontally and vertically, it appears that the deposition of the sediments of almost the whole Carboniferous of Central and Western Bohemia took place in a time-span of a relatively intensive volcanic activity. The greater part of the effusive bodies lying outside the sedimentation basin were probably exposed by erosion; analogously, the present-day distribution area of tuffs and tuffogenous rocks was markedly influenced by various

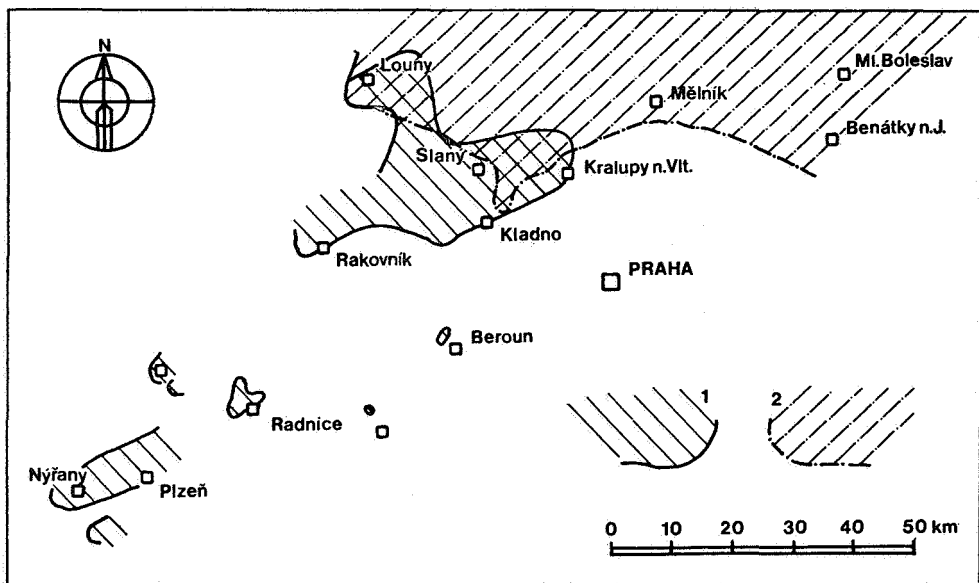


Fig. 3. Schematic representation of the widest distribution of the volcanogenic rocks of the earlier and the later groups.

- 1 — The earlier group of volcanogenic rocks.
- 2 — The later group of volcanogenic rocks.

rocks which also occur in the younger group. The latter are especially agglomerates, agglomerate tuffs, lapilli, sand, and ash tuffs, particularly of acid igneous rocks. These have been characterized in detail (Tab. 2) by J. Mašek (1973).

In the ideal geological section of the Carboniferous of central and western Bohemia, upto 26 stratigraphically different and vertically more or less distant layers or sets of layers of volcanogenic character can be distinguished. Their sequence shows an evident continuity in space and time as well as the initial composition of the subsequent Variscan volcanism. According to J. Mašek (1967), the manifestations of subsequent volcanism become manifest in the environs of the town of Slaný, even in the beds underlying the Upper Carboniferous sediments. Later, in the weakened zones of the Variscan orogeny, subsidence movements set in, due to changes in the tectonic regime, along the lines of radial tectonics. In the basin and outside it, major or minor effusive lava bodies

occurred along rents in the rocks. Their origin was associated with deposition or discontinuous layers of volcanic extrusions.

The earlier group of volcanogenic rocks

In the Radnice Member (Tab. 1), whose sediments have been preserved on about a third of the area of the Central and Western Bohemian Carboniferous, a maximum of the Carboniferous volcanic activity (or its reflection) can be observed. At first, sporadic occurrences of tuffogenous rocks are encountered as well as an isolated effusion, underlying at depth the Radnice Group of seams. Then igneous rocks were deposited between the Lower and Upper Radnice seams which always being stratigraphically persistent formed a big body, unusually thick, the Břasy Horizon. Its rocks can be traced in two parallel stripes striking $\pm 45^\circ$. Their degree of preservation reflects the structure of the bedrock of the Carboniferous at the time of origin

TABLE 2

Survey of the products of the Upper Carboniferous volcanism in Central Bohemian Basins
(According to J. MAŠEK 1973)

Effusive rocks	quartz porphyries			
	melaphyres			
Volcanic breccias				
Pyroclastic rocks	quartz-porphry-tuffs	agglomerates	lithic	biotite
		lapilli		
		sand	crystalline	quartz-sanidine
			vitrocrystalline	
			crystallo-vitric	
		ash	vitric	massive
				“graupen” tonsteins
melaphyre-tuffs				
mixed and tuffogenous rocks	tuffites	with non-redeposited volcanic material		
		with material redeposited for a short distance		
	tuffaceous sandstones and claystones			
	tuffogenous claystones			

of the Radnice Member — the oldest rocks of the whole sedimentary complex. The character of the effusive rocks found here, and the variability of the tuffs of this unit bears witness of the possible existence of several centres of volcanic activity in various places of the Central Bohemian Basin (especially in the Kladno-Rakovník Basin and in south-western Bohemia).

In the beds overlying the Upper Radnice seam, refractory claystones of volcanogenic origin occur approximately between Rakov-

ník, Slaný, and Kladno, while very thick effusive bodies also dating from the same time, have been established in north-western Bohemia, so that their existence can be assumed in the wider vicinity of Rakovník (fig. 4).

During the time of generation of the Nýřany Member, the manifestations of an intensive volcanism appear especially in Western Bohemia — in the Carboniferous of the Plzeň Basin and the Manětín “island” (figs. 5 and 6). The stratigraphically most persistent layer

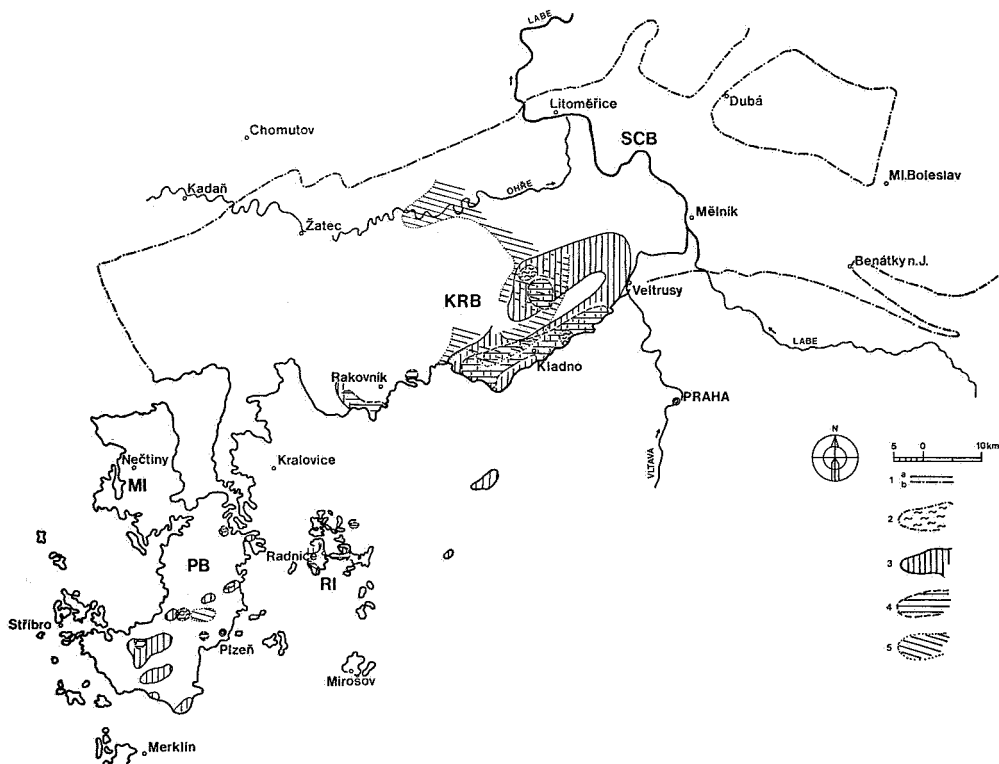


Fig. 4. Distribution of the volcanogenic rocks of the Radnice Member.

1 — boundary of the Carboniferous of Central and Western Bohemia (a — proved, b — assumed),
 2 — boundary of the oldest volcanogenic layers, 3 — boundary of the volcanogenic layers of the Břasy Horizon, 4 — boundary of the volcanogenic layers in the Upper Radnice seam, 5 — boundary of the volcanogenic layers younger than those in the Upper Radnice seam; PB — Plzeň Basin, MI — Manětín "island", RI — Radnice "island", KRB — Kladno-Rakovník Basin, SCB — Sub-Cretaceous Basin.

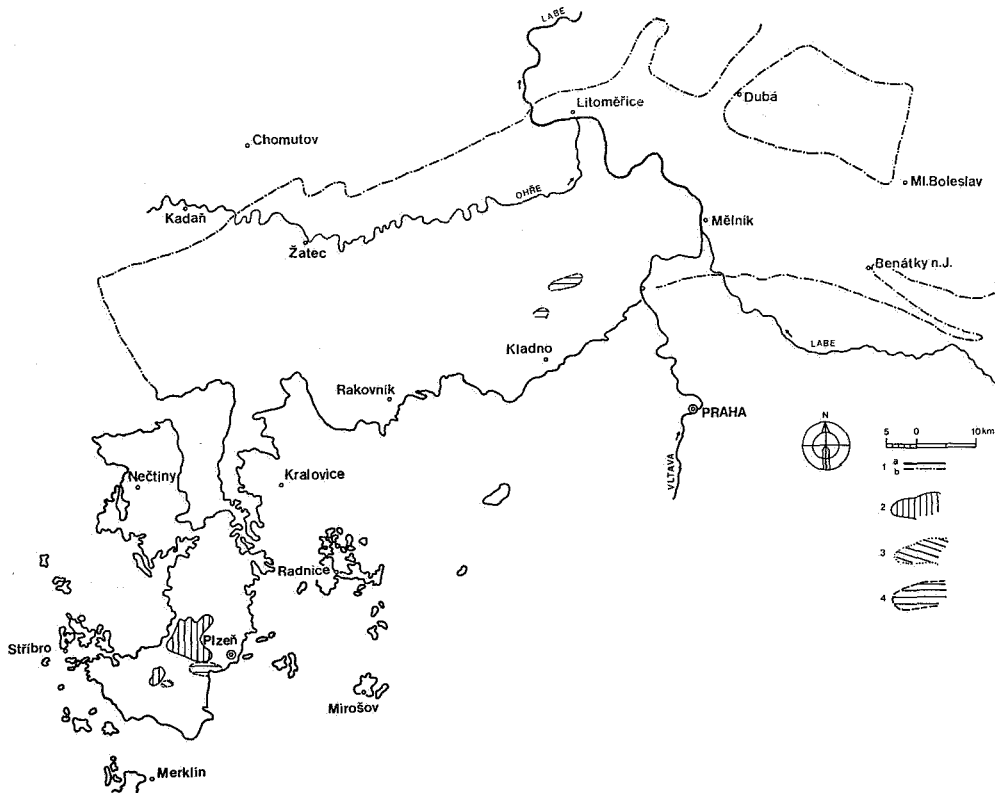


Fig. 5. Distribution of the volcanogenic rocks in the lower part of the Nýřany Member.
 1 — distribution of the Carboniferous in central and western Bohemia (a — proved, b — assumed), 2 — boundary of the volcanogenic layer of the so-called brown tuffite at the base of the Komerberk Horizon at the base of the Nýřany Member, 3 — boundary of the volcanogenic layer: so-called bakala (Nýřany group of seams), 4 — boundary of the volcanogenic layer in the lower part of the Nýřany Member (overlying the so-called brown tuffite and the rock of the "bakala" type).

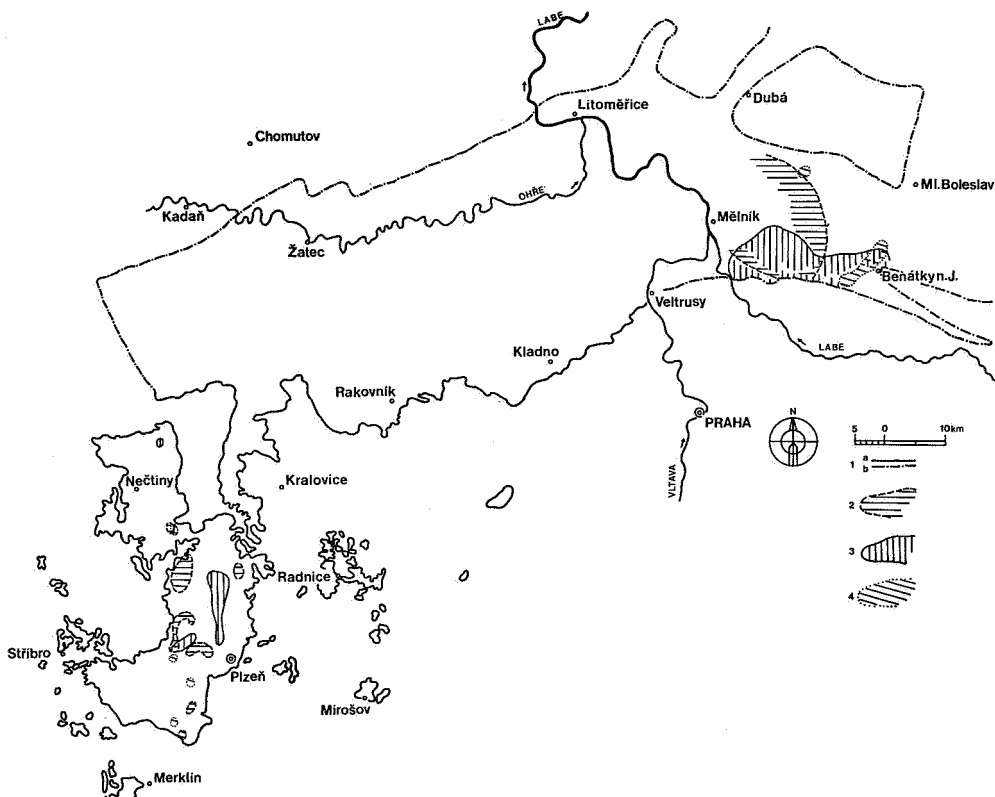


Fig. 6. Distribution of the volcanogenic rocks in the upper part of the Nýřany Member and in the Týnec Formation.

- 1 — distribution of the Carboniferous in Central and Western Bohemia (a — proved, b — assumed),
- 2 — distribution of volcanogenic layers in the upper part of the Nýřany Member (underlying the top part),
- 3 — boundary of the latest volcanogenic layers of the Nýřany Member,
- 4 — boundary of the volcanogenic layers in the Týnec Formation.

n this area is that of the so-called brown u fite (J. MAŠEK and J. PEŠEK 1966) lying beneath the Komerk Horizon, at the base of the Nýřany Member in the Plzeň Basin.

In the subsequent Týnec Formation (fig. 6) the volcanic activity dies out. Its manifestations have been encountered especially in the Sub-Cretaceous Basin, east of the river Vltava (V. SKOČEK 1970) and less in the southern part of the Plzeň Basin (J. PEŠEK, V. SKOČEK 1972).

The later group of volcanogenic rocks

Although from the lithological point of view both youngest Formations — being

composed of fine lacustrine sediments — are more suitable for preservation of the volcanogenic rocks, the percentage of volcanogenic rocks in them is smaller than that in the earlier group. This accounts for a generally reduced intensity of volcanic action. In the Jelenice Member several volcanogenic layers have been established especially in the vicinity and within the Mělník Group of seams, however, in the area of the Sub-Cretaceous Basin, east of the river Vltava only. It should not be neglected that at the time of intensified volcanic activity, relatively thick seams arose even here, similarly as with the upper Radnice seam which came into being after deposition of the volcanogenic

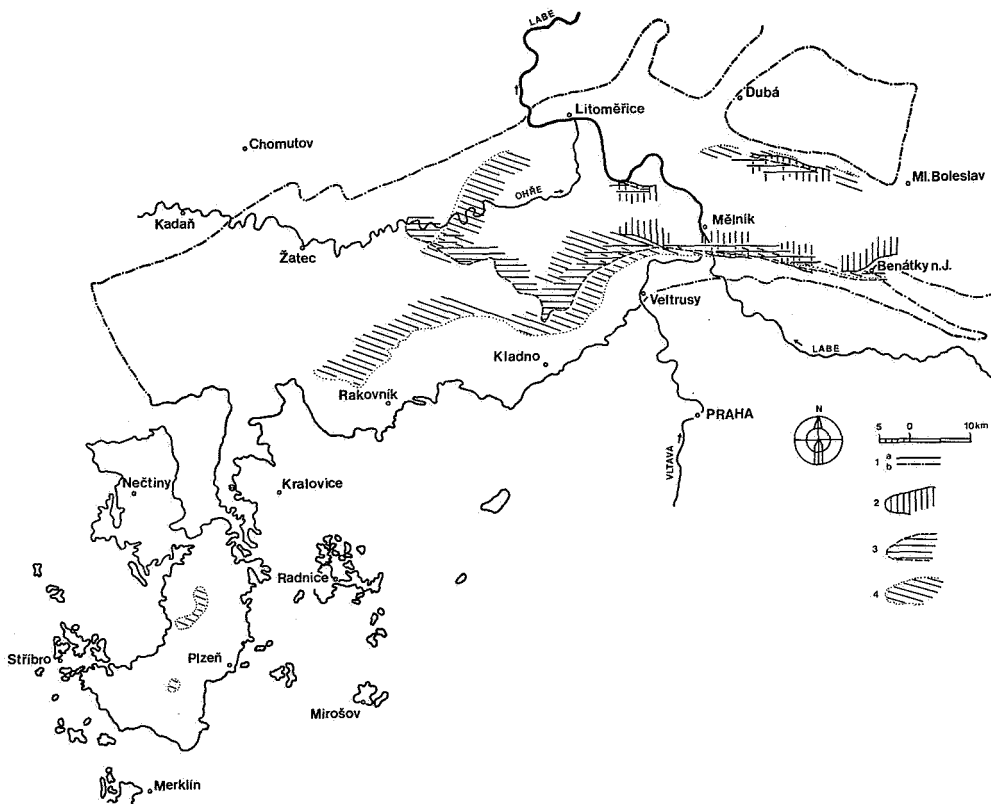


Fig. 7. Distribution of the volcanic rocks in the Slaný Formation.

1 — distribution of the Carboniferous in Central and Western Bohemia (a — proved, b — assumed), 2 — boundary of the volcanic layers in the Jelenice Member, 3 — boundary of the volcanic layers in the Malesice Member, 4 — boundary of the volcanic layers in the Kounov Member.

rocks of the Břasy Horizon. During the generation of the Upper Radnice seam, numerous volcanic partings were deposited directly in this seam. Many thin (mm, cm) layers settled in the environs of Kladno and in the north-western Bohemia, as well as in the Sub-Cretaceous Basin in the lower part of the Malesice Member, especially in the laminated claystones (so-called Mšec claystones), and directly above them. It seems that the so-called “kamínek” of the Kounov Member is stratigraphically most persistent. A layer of the latter, several cm to dm thick, occurs practically in all other areas where the sediments of the Kounov Member have been preserved (fig. 7), except for western Bohemia, where the “kamínek” has not been found everywhere. In the latest

formation, the Lině Formation, a considerable number of volcanic layers have been observed in the environs of Kladno and in the Central Sub-Cretaceous Basin (fig. 8).

By the deposition of the Upper Stephanian sediments was terminated the sedimentation in the Carboniferous of Central and Western Bohemia. Evidence of the Lower Permian violent manifestations of volcanic activity has been obtained only in the north and the east of the area studied. Thus, as the Lower Permian sediments are absent in the area under consideration, it cannot be decided with certainty whether the evidence of this volcanic activity is lacking at all or whether it has not been preserved.

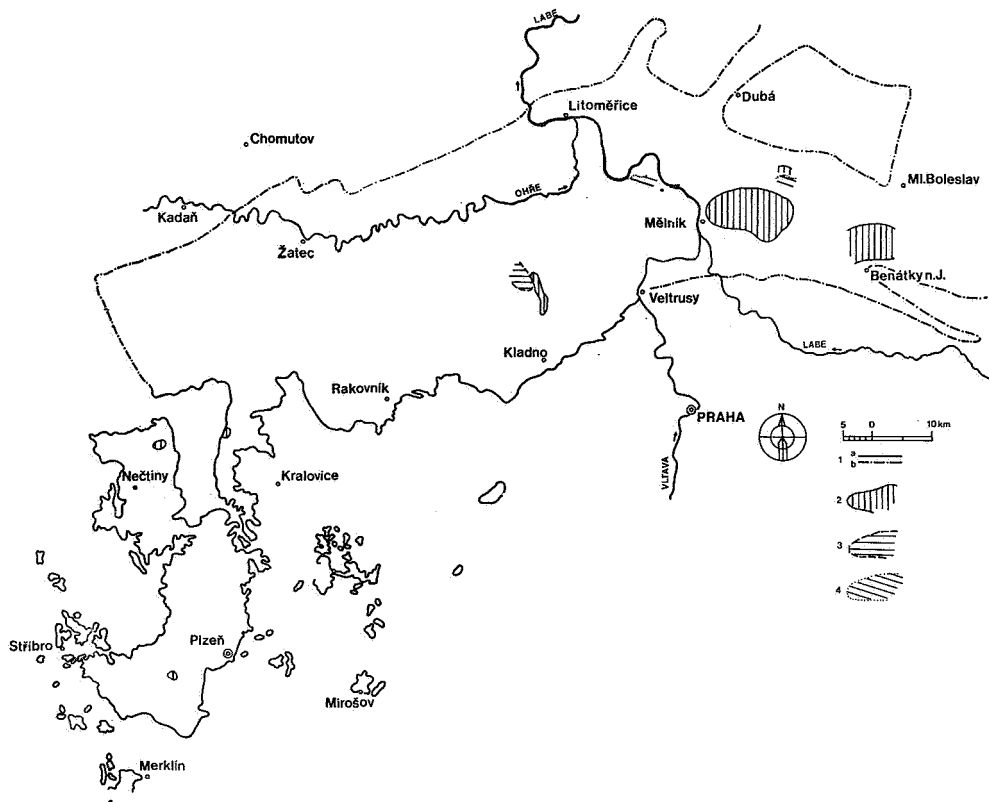


Fig. 8. Distribution of the volcanogenic rocks in the Líně Formation.

1 — distribution of the Carboniferous in Central and Western Bohemia (a — proved, b — assumed), 2 — boundary of the volcanogenic layers at the level of the Zdětín Horizon, 3 — boundary of the volcanogenic layers at the level of the Klobuky Horizon, 4 — boundary of the volcanogenic layers overlying the Zdětín and Klobuky Horizons.

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