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CONTROLLING HUMAN GEOGRAPHY

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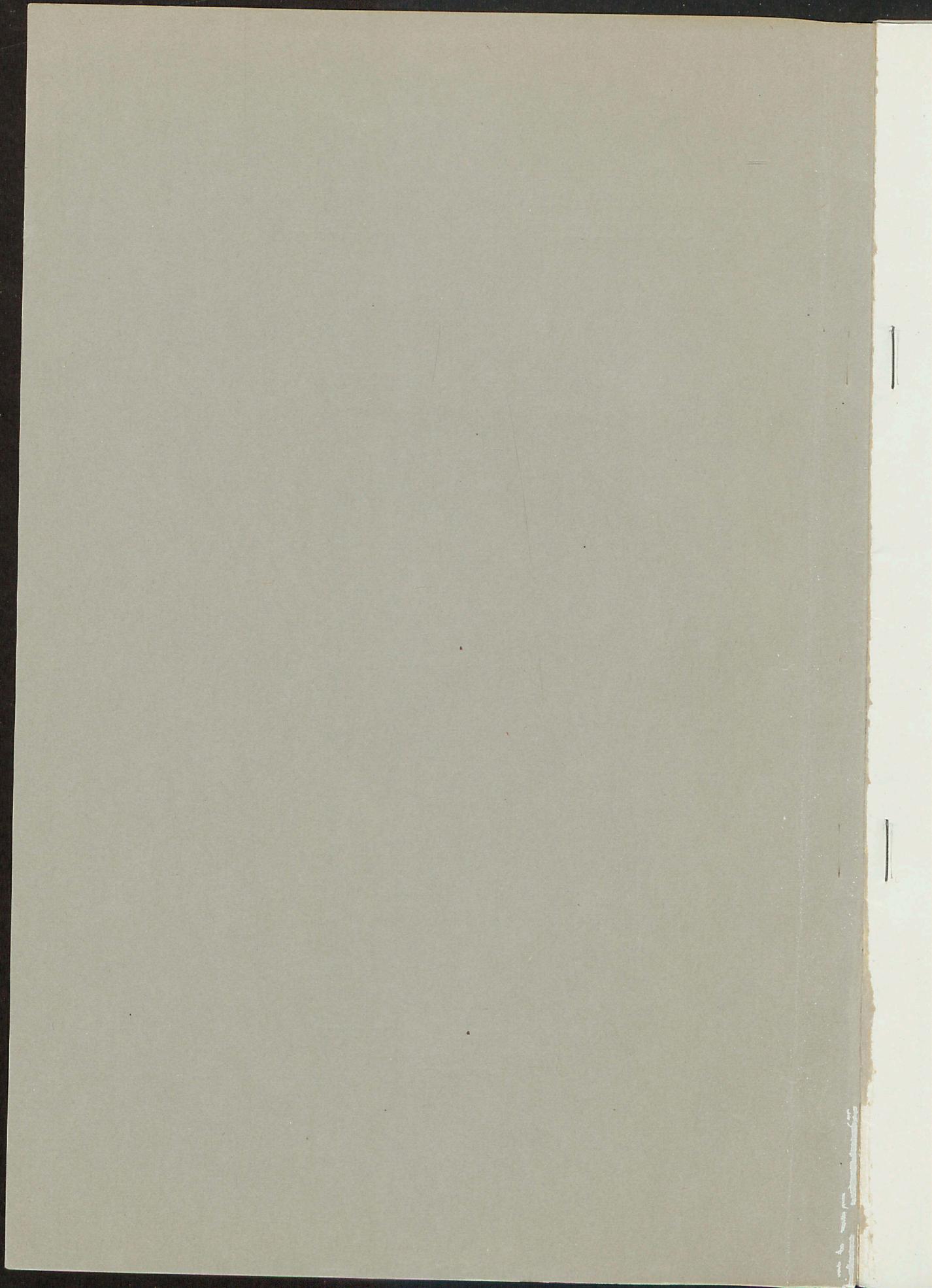
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THE CARPATHIANS: PHYSIOGRAPHIC FEATURES CONTROLLING HUMAN GEOGRAPHY*

By EMMANUEL DE MARTONNE

Professor of Geography at the University of Paris

[With separate map, Pl. IV, facing p. 432.]

Though the Carpathians are one of the great mountain chains of Europe they are not so widely known as the Alps. They have no glaciers and no high mountain scenery to attract the tourist. History has rarely been gravely affected by them, and only the great European war has revealed their strategical importance. Very few physiographers have carried on elaborate field studies in the Carpathians. We even have no accurate topographical maps of portions of the Southern Carpathians, and the writer in studying this region was obliged first to survey extensive areas and in doing this discovered twenty unnamed lakes in the Paringu massif. Nevertheless the Carpathians, no less than the Alps, teach some wonderfully clear lessons in physical and human geography.

The length of the Carpathians, measured from Pressburg to the Iron Gates, is nearly equal to the length of the Alps, and the area is likewise the same. But the mean height is much lower, and the maximum height is a little more than half (Tatra, 2,663 meters, or 8,737 feet; Mont Blanc, 4,810 meters, or 15,781 feet). The Carpathians are ordinarily believed to be a true "alpine chain," that is to say, one of those young folded mountains which extend across Europe and Asia from the Pyrenees to the Himalayas. Their outline is that of a bow, with a more definitely marked outer front; but the map (Pl. IV) shows that the bow is nearly broken in the middle. The width of the chain is reduced at this point from 300 to less than 100 kilometers (180 to 60 miles); its mean height falls below

* The following comment on the spelling of place-names in the article and on the map may be serviceable. Hungarian and Rumanian names are given in their native form, diacritical marks being omitted, however; and no phonetic transliteration has been attempted except in the case of the Rumanian *t*, which has been rendered *tz*. In addition it should be borne in mind that Hungarian *s* and Rumanian *ș* are pronounced *sh*, e.g. Fogaras, *Fogarash*; Pitești, *Piteshti*; Arges, *Argesh*, etc.

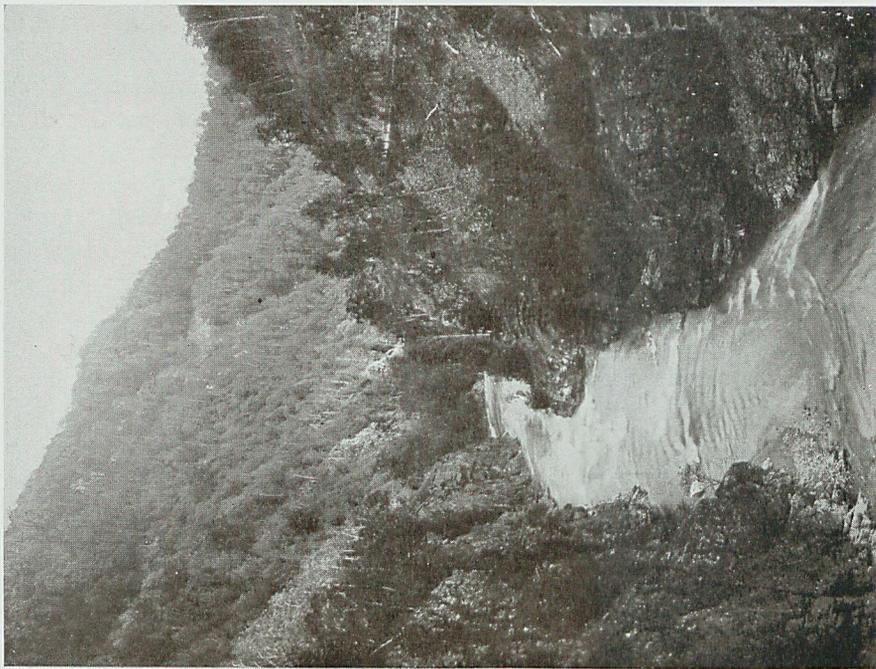


FIG. 1.

Fig. 1—The Surduc gorge; transverse valley of the Jiu River across the Transylvanian Alps between Petroseny and Targu Jiu.

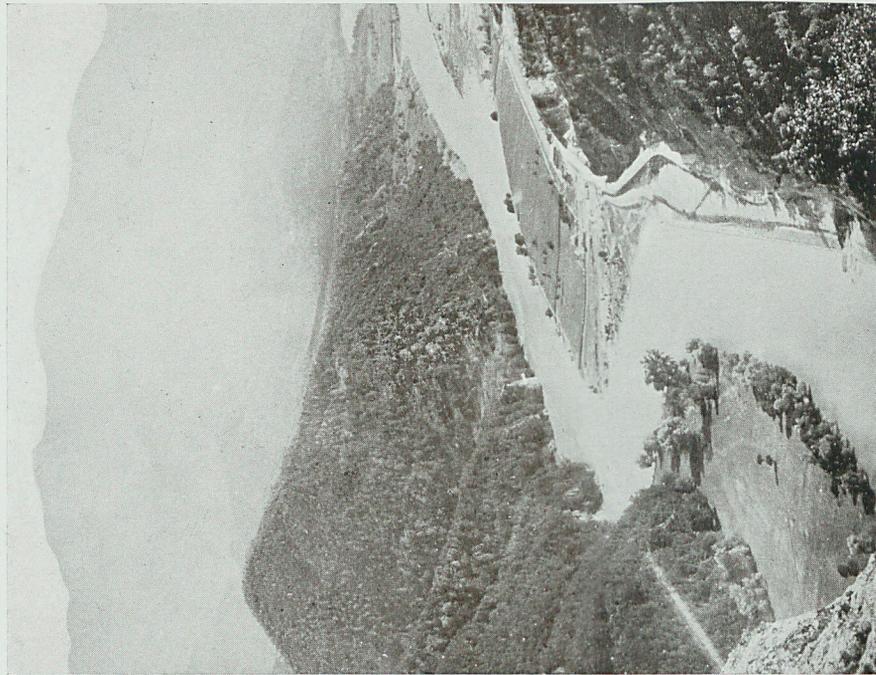


FIG. 2.

Fig. 2—Transverse valley region of the Olt River; looking down to the main valley of Titesti. Maturely dissected flysch basin; wide, open valley with terraces and alluvial flats.

1,000 meters (3,300 feet), and a group of very low passes connects the headwaters of the Dniester with those of the Tisza.

This peculiar feature is one of greatest importance because it controls in a fundamental way the biogeography, economic life, and military strategy of the area. We know from the studies of Pax¹ that important types of vegetation extend bandlike through the Dukla Pass. Three railroads cross the Carpathians in this region, viz., by the Lupkov Pass, the Uzsok Pass, and the Verecze Pass. It is by these easy passes that the Magyars, coming from the plains of southern Russia, made their way to the plain of the middle Danube, which they have occupied since the eighth century. In the present war, this is the only place at which the Russians have yet succeeded in crossing the Carpathians and menacing the capital of the Austro-Hungarian Empire.

That a young folded mountain range is so shrunk in the middle of its bow can be explained only by downwarping and breaking. As a matter of fact, the great Hungarian plain, which here extends northward into the very heart of the Carpathians, has been proved to be an area of continuous subsidence, its Neocene beds extending 1,000 meters (3,300 feet) below sea level. The upper Tisza flows at an altitude of only 100 meters even at the foot of the mountains. All the geological horizons exhibited in the Carpathians are missing here, and what remains of the range is only the outer belt of flysch* sandstones. Volcanic massifs show by their structure and distribution that fracturing accompanied downwarping.

Through this shrinking the Carpathians were divided into two masses, now entirely different as to orographic and geologic structure and no less different regarding their biogeography and human geography.

The Northern Carpathians, although bearing the highest peaks of the whole chain (Tatra, 2,663 meters, or 8,737 feet), have not so great a mean height as the Southern Carpathians. They appear as a complex of isolated massifs, broad and low depressions and basins—an extremely shattered range; while in the Southern Carpathians the most striking feature is the great basin of Transylvania, surrounded on all sides by high massifs. The geological structure of the Northern Carpathians is very complicated, and in this respect it is hard to find any relation between the Northern and the Southern Carpathians. The only formation which extends from one to the other is the outer belt of folded flysch sandstones, and even these do not continue into the Transylvanian Alps.

Because of the location of this part of the range the climate and the plant life of the Northern Carpathians are like those of the bordering plains of Poland. In the Beskids a dense forest of firs and beeches extends down to

¹ F. Pax: Grundzüge der Pflanzenverbreitung in den Karpathen, Vol. 1 (*Die Vegetation der Erde*, edit. by Engler and Prude, Vol. 2), Engelmann, Leipzig, 1898.

* Flysch is the name, of Swiss origin, given to the complex of marly and sandy shales and soft sandstones, probably of Eocene or Oligocene age, which accompany the outer, convex border of the Alps and the Carpathians.—EDIT. NOTE.

the very foot of the mountains. The timber line is remarkably low, the alpine zone commencing at 1,400 meters (4,600 feet) in the Tatra. The vine is not grown; few fruit trees are seen, except in the southernmost massifs bordering the great Hungarian plain. The climate of the Southern Carpathians is continental to a high degree, and the winters are as severe in the Transylvanian Basin as in the valleys of the Beskids, but the summers are warmer. The vine is grown everywhere, and corn is cultivated up to 800 meters (2,600 feet). The timber line is found at 1,800 meters (5,900 feet). The alpine flora is richer. The subalpine forest zone, with fir and beech, does not extend down to the lowlands; it is the oak forest which covers the basal slopes.

Even in ethnographical conditions and economic life there are striking contrasts between the Northern and the Southern Carpathians. The former are inhabited mainly by North Slavs, while the Magyars penetrate the valleys which open widely southward to the great Hungarian plain, and their distribution coincides precisely with the dry climate, the oak forest, the vineyards, and the loess soil which is so well fitted for wheat culture. The Southern Carpathians are the domain of the Rumanians. Magyars appear only in the Transylvanian Basin, while the Ruthenians occupy the northern corner in Bukovina and eastern Galicia. The upper limit of the permanently inhabited region is everywhere much lower than in the Alps, but it seems to be particularly low in the Northern Carpathians, where, with the exception of some mining towns, we find that even villages do not occur higher than 700 meters (2,300 feet). By contrast, in the Southern Carpathians fields and small villages may occasionally be seen as high as 1,000 meters (3,300 feet). Pastoral life is much more developed, and in the summer large flocks of sheep graze over the flat-topped ridges above the timber line.

The Northern Carpathians are not easily accessible from any important commercial highway. The railways avoid crossing them, as, for example, the main line from Vienna to Cracow and Lemberg. The Southern Carpathians cannot be avoided by the commerce directed to the Orient and are crossed by two trunk railways with express service, namely, at the Iron Gates and at Predeal Pass, and by three railways of less importance, mainly by way of the transverse valley of the Olt (Red Tower Pass), the pass between the upper Olt and the Sereth (Gyimes Pass), and the pass between the headwaters of the Tisza and the Pruth (Jablonica Pass).

THE TRANSYLVANIAN ALPS

It is in the Southern Carpathians that the most intensive physiographic studies have been carried on.²

The Transylvanian Alps form the southernmost part of the Carpathians

² E. de Martonne: Recherches sur l'évolution morphologique des Alpes de Transylvanie (Karpates méridionales), *Revue de Géogr. Annuelle*, Vol. 1, 1906-07, pp. xi-xxi (bibliography) and 1-279.

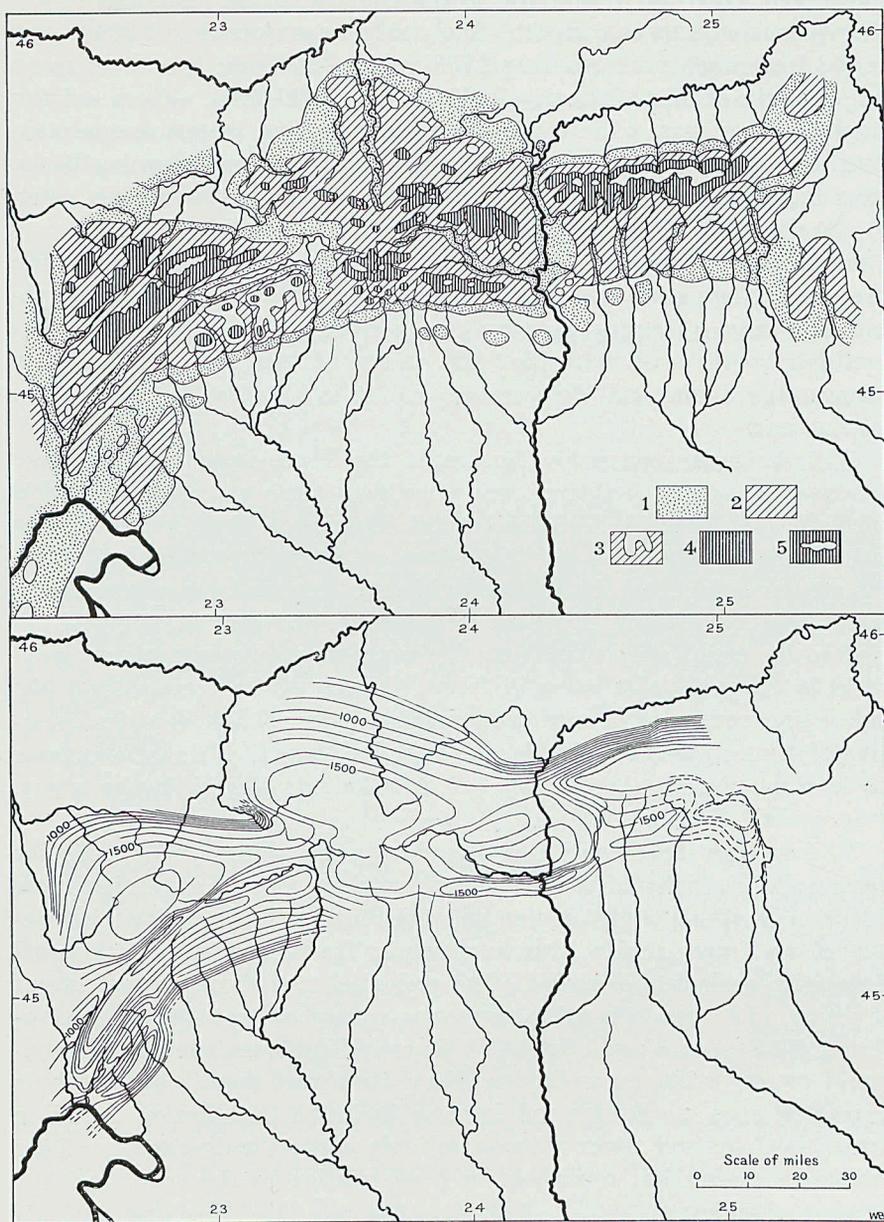


FIG. 3 (Upper)—Map showing the extent of the forms of advanced maturity developed in the Transylvanian Alps at three successive stages. Scale, 1:2,300,000. Key to legend: (1) Gornovitz platform (Pliocene); (2) Riu Ses platform (late Miocene); (3) maturely dissected Boreasco monadnocks; (4) Boreasco platform (probably early Miocene); (5) pre-Boreasco monadnocks.

(Lower)—Map showing the present altitude of the Riu Ses platform as a result of diastrophic movements. Scale, 1:2,300,000. Interval of structure contours, 100 meters.

(Fig. 3 is redrawn from Fig. 55-56 of the author's "Recherches, etc.," cited in footnote 2.)

and extend from the Iron Gates to the Prahova River. No part of the Carpathians appears so compact. Many ridges are more than 2,000 meters (6,500 feet) high, some reaching 2,500 meters (8,200 feet), and the mean height of the summits is nearly 1,800 meters (5,900 feet). There are few longitudinal valleys, while transverse valleys, cutting the whole mountain mass, are occupied by streams which come from the Transylvanian Basin, cross the highest ridges, and flow to the lower Danube—as the Jiu (Fig. 1), the Olt (Figs. 2 and 11), and the Buzeu. These valleys are not everywhere such wild gorges as the Surduc (gorge of the Jiu) or the Red Tower Pass; and they have consequently been followed by migrating peoples and especially by strong military forces crossing the range. This was particularly the case with the Olt valley at the time of the wars between the Turks and Hungarians, and it is likewise the case in the present war.

But the most remarkable feature of the Transylvanian Alps is the flatness of most of the ridges, even when they reach an altitude of 2,000 meters (6,600 feet). Indeed the hardest climbing in these mountains has to be made, as a rule, at the beginning, over primitive pathways, while you are ascending from the valleys, which are often wild gorges and nearly everywhere remarkably profound and steep-sided. But after you have reached the crest, you can walk or ride whole days on comparatively good paths in the midst of a splendid forest. When you have risen above the timber line, you travel over extensive pasture grounds, dotted, at the beginning of summer, with the most beautiful alpine flowers. This is the domain of the Rumanian shepherds; they call these heights *plaiuri*, that is to say, "the paths" (Fig. 9).

The contrast between the topographic youth of the valleys and the topographic maturity of the heights suggests the idea of a physiographic evolution involving peneplanation and rejuvenation. The geological structure of the Transylvanian Alps, as shown by the studies of Rumanian and Hungarian geologists, is alpine. The geological map shows a great extent of schists, which are referred to two series corresponding to two great overthrust masses, and a small extent of Mesozoic limestones, shales, and sandstones corresponding to an intermediary overthrust mass. Neocene beds appear only on the border and in some basins in the interior, revealing superficial folds and faults without any relation to the dislocations of the overthrust masses but sometimes in close relation to the relief and the network of valleys.

Investigations have shown that the Transylvanian Alps exhibit three series of flat-topped ridges, corresponding to three periods of more or less extensive peneplanation after the piling up of the overthrust masses which gave the range its elevated character (Fig. 3). The highest flat-topped ridges appear sometimes at 2,000 meters (6,600 feet). This surface I have called the Boreseo level, from the mountain which exhibits the most remark-

able example of it (see panorama, Fig. 5). Indeed you can walk all day long in the fog on the slightly undulating plateau and cross swampy grounds with peat bogs, without knowing where you are, until the wind suddenly shifts, the fog is dispelled, and you find yourself on the verge of a valley a thousand meters deep.

The Boreasco surface is very old, probably of early Miocene age, and is only preserved in some of the highest massifs. It has been much modified

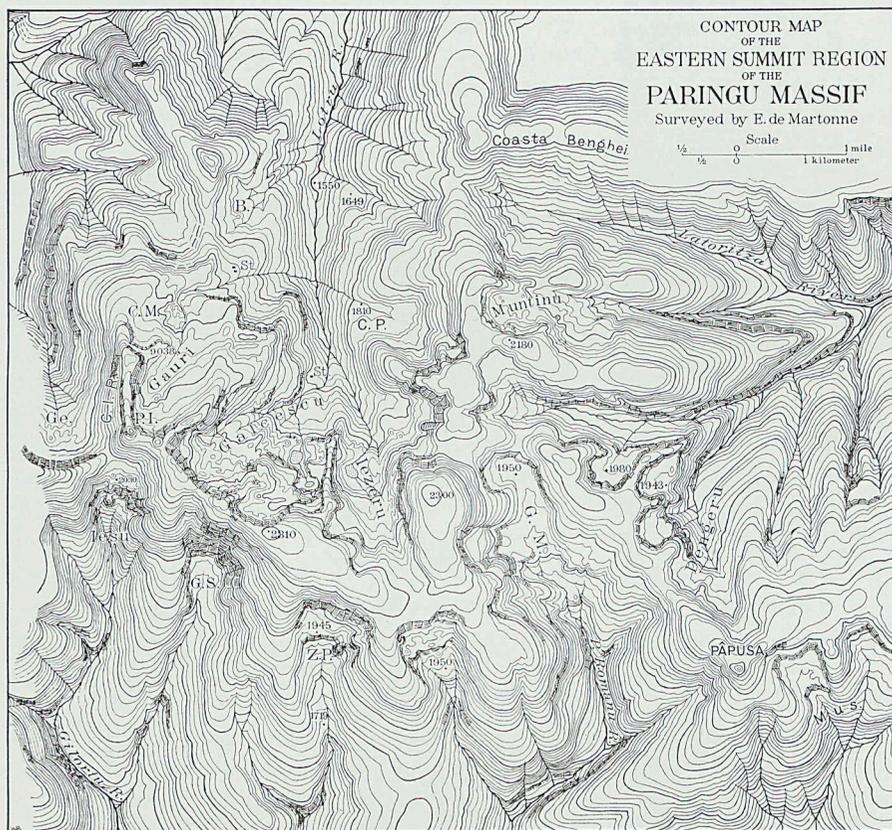


FIG. 4—Contour map of the eastern summit region of the Paringu massif, Transylvanian Alps, reduced from the author's original survey in 1:25,000, showing glacial cirques and the great extent of the Boreasco platform. Scale, 1:110,000. Contour interval, 20 meters. (Redrawn from Fig. 57 of the author's "Recherches, etc.," cited in footnote 2, which consult for key to abbreviations.)

by the action of local Pleistocene glaciers. Beautiful cirques with precipitous walls, carved in the domed surface of the Paringu massif, locally give it the appearance of an alpine mountain with sharp ridges and many lakes (Fig. 4). Where the peneplanation was not completed in Boreasco time monadnocks were left standing above the Boreasco platform, and these have been extensively scalloped on both sides by great cirques or even by glacial valleys containing beautiful examples of trough steps and rock

basins. Sharp ridges, pyramid-like peaks, and narrow passes have been developed in this way in the Retiezat and the Fogaras massifs.

The second surface from which flat-topped ridges have been derived by erosion is called the Riu Ses. It is the greatest in extent, and we may assume that it was a true peneplane surface, developed in the late Miocene, as shown by the study of its contact with the Tertiary hills in the Mehedintzi plateau. To the west of Hermannstadt it appears as a plateau dissected by many valleys into parallel flat-topped ridges which descend regularly to the north.

Where the Boreseo surface is preserved over a large extent the Riu Ses surface forms young dissected esplanades, as in the Retiezat massif, or old valleys, as in the Riu Ses region itself. Sometimes Boreseo monadnocks stand above it in the form of table-like reliefs, as in the Vulcan Mountains (Fig. 6).

It is on the flat-topped ridges, remnants of the dissected Riu Ses surface, that most of the old trails of the Transylvanian Alps are located. The well-known "Vulcan Pass," which has been often referred to in the present war, is not the wild gorge of the Jiu, as shown in many newspaper maps; neither is it a true pass. It is one of the *plaiuri* frequented by the shepherds. In this particular case the road follows a Riu Ses ridge which slopes gently to the south, thereby avoiding the wild gorge of the Jiu. This road was known to the Roman soldiers and merchants; and, before the building of the modern and expensive road in the Surduc gorge, it was the only means of communication between the mining town of Petroseny and the great market of Targu Jiu. Starting from the Petroseny side it is hard to reach the top, and this part of the road was strongly defended by the Rumanians in the autumn campaign of 1916. When you are once on top, on the Riu Ses surface, you can descend without difficulty to the Targu Jiu basin to the south.

The most recent surface is the Gornovitza surface, which exhibits a late-mature topography, developed on Pliocene strata. Its extent is not so great as the extent of the Riu Ses surface, and it appears ordinarily in the form of young dissected esplanades, as to the south of the Vulcan Mountains, with wild gorges cut in the Mesozoic limestones, or in the form of old valleys, now more or less dissected, making shoulders or rounded terraces above the present bottom of the young valley. The Surduc gorge is cut in such an old Pliocene valley, as is also the transverse valley of the Olt.

The whole physiography of the Transylvanian Alps, with the exception of the glacial forms of the highest Boreseo summits, is explained by the extent of the deformation and dissection of the three surfaces of old maturity, developed at three different periods. Such features should influence, at least to some degree, the biogeography of the area and even its human geography. As a matter of fact, the alpine flora is richer in the Transylvanian Alps than in other parts of the Carpathians and especially

where the Boresco or Riu Ses surfaces extend above the timber line and are cut in limestone and sandstones, as in the Bucegi massif. We have already stated that the shepherds use the flat-topped ridges called *plaiuri* as pasture grounds. The great extent of these alpine and subalpine meadows and the vicinity of the steppe plains of Wallachia explain the annual migrations of the Rumanian shepherds, who spend the summer in the mountains and the winter in the plains. The sheep that are taken to the Baragan Steppe and even to the Dobrudja are often owned by peasants from Transylvania, and many of the shepherds are Transylvanians.³ Villages recently established in the steppes of Muntenia are inhabited by Rumanian peasants from Transylvania, of whom many have been shepherds.

No one who has lived with shepherds in the mountains can fail to remark how pastoral life conduces to the preservation of old habits and peculiar customs. This makes it less difficult to understand how the Rumanians could remain a distinct people with a Latin language, while during many centuries wave after wave of barbaric invaders rolled over the plains of the lower Danube.⁴

While the flat-topped ridges extending near and above the timber line are used as pasture grounds and scattered with small, temporarily inhabited, wooden houses called *stine* (Figs. 10, 14, 15), many of the shoulders, rounded terraces, flat-topped ridges, and plateaus extending down into the forest zone below 1,200 meters (3,900 feet) are occupied by farms with meadows and orchards. In the main the villages lie near the floor of the valley; but many peasants own a small farm on a shoulder nearby, where they keep cattle in the summer. The great extent of comparatively high-standing flat-topped ridges and their use as pasture grounds by shepherds migrating to the plains of the lower Danube may be considered as one of the reasons why pastoral life has not developed in the same way as in the Alps, why so few villages are found above the valley floor, and why the limit of the permanently inhabited region is at a comparatively low elevation.

We must here note a peculiar feature of the Transylvanian Alps, the study of which not only affords evidence regarding the successive stages of deformation and erosion of the mountains but explains many interesting features of their human geography. It is what has been termed "sub-Carpathian depressions." The most conspicuous of them is the depression of Targu Jiu, which the Jiu enters when issuing from the wild Surduc gorge before cutting into the Tertiary hills of Oltenia. There are many such depressions in Oltenia and in Muntenia, appearing as a chain of flood-plains or of young dissected alluvial plains between the range itself and the wooded and strongly dissected Tertiary hills. We know that all these depressions originated as synclines on the contact of the old rock masses

³ E. de Martonne: *La Valachie: Essai de monographie géographique*, Colin, Paris, 1902.

⁴ E. de Martonne: *La vie pastorale et la transhumance dans les Karpates méridionales; Leur importance géographique et historique*, in "Ratzel Gedenkschrift," Seele & Co., Leipzig, 1904, pp. 227-245.

and the Neocene beds. Pontian marls are folded in western Oltenia; late Pliocene gravels are dislocated in western Muntenia; Pleistocene terraces are tilted and in some places broken by flexures in eastern Muntenia.

The sub-Carpathian depressions are drier and warmer than the surrounding country. They have few woods, are very well cultivated, and are more densely populated than even the Tertiary hills.⁵ The villages seem prosperous. Wealthy peasants are not unknown. Every one possesses cattle, fields, and orchards; and the village community owns heavily timbered mountains with pasture grounds. It is in such places that you find Rumanian costumes in their most typical and beautiful form. History tells us that, while the peasants in the whole of Wallachia were serfs, most of the villages of the sub-Carpathian depressions were inhabited by *moshneni*, i. e., freemen, who owned their own fields and homes.

Small towns have developed in every sub-Carpathian depression, such as Targu Jiu, Ramnic, and Campulung; they lie at the head of commercial routes crossing the range. In the present war the rôle of the sub-Carpathian depressions has been quite remarkable. The defeated Rumanians rallied in the Targu Jiu depression and in the Campulung depression to check the Germans; and stubborn battles were fought at such places.

THE TRANSYLVANIAN BASIN AND THE BORDERING MOUNTAINS

The Transylvanian Alps are only a part of the Southern Carpathians, which form the southern border of the Transylvanian Basin.

The western border, the Bihar massif, seems to have the same geological structure and the same physiographic history as the Transylvanian Alps, although its height and extent are not so great. The Riu Ses surface seems once to have extended over the larger part of this region. The highest summits of today are probably Boreasco monadnocks fringed in some cases by very small cirques. Where the old surface was cut in limestones and is dissected only by wild narrow gorges, the fields and villages are on the heights; where it is cut in schists and dissected by more open valleys, the population lives in the valleys, as in the Transylvanian Alps.

Pliocene shore lines have been discovered to the west by Sawicki.⁶ They seem to correspond to the highest terraces of the Maros and to the summit of the Tertiary hills of the Transylvanian Basin. The Neocene beds are slightly undulating and even faulted in places, and it is therefore clear that the Transylvanian Basin had the same physiographic history as the smaller basins of the Transylvanian Alps, which have been more or less disturbed by the deformations of the old rock masses of the mountains. In addition they were peneplaned in the Pliocene and strongly dissected later.

⁵ E. de Martonne: Recherches sur la répartition géographique de la population en Valachie, *Bull. Soc. Geogr. Romina (Bukharest)*, Vol. 23, 1902, No. 2 (= pp. 1-161).

⁶ L. Sawicki: Beiträge zur Morphologie Siebenbürgens, *Bull. Internat. de l'Acad. des Sciences de Cracovie: Classe des Sciences Math. et Nat., Ser. A*, 1912, pp. 130-265.

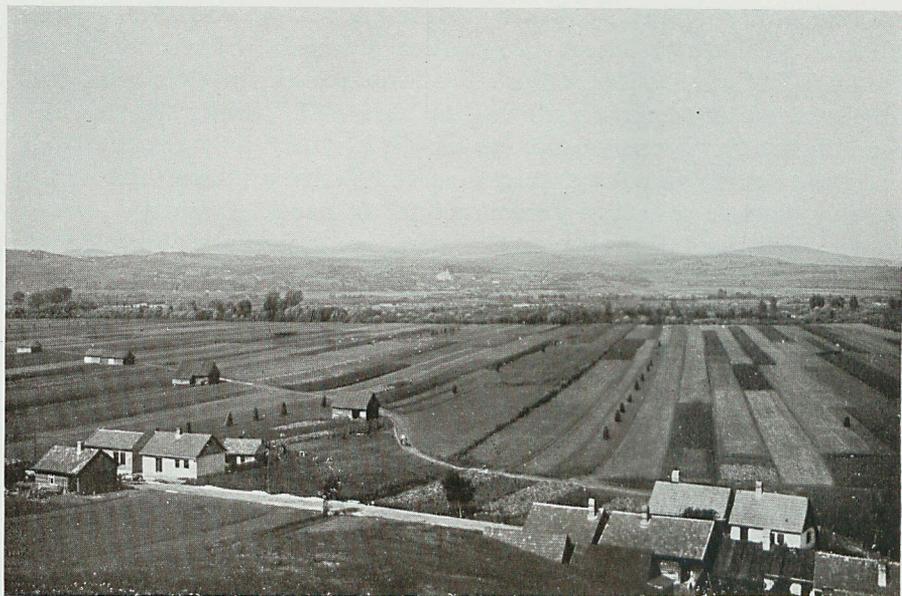


FIG. 8.



FIG. 9.

FIG. 8—The Beskidic peneplane surface of the Northern Carpathians and the first Beskidic monadnocks. (Photo by W. Lozinski.)

FIG. 9—Flat-topped ridges, called *plaiwi*, i.e. the paths, in the Transylvanian Alps. View taken in the Capatzina Mountains, looking west. In the background the sky line shows the level summits of the Paringu massif (high Boreasco platform).

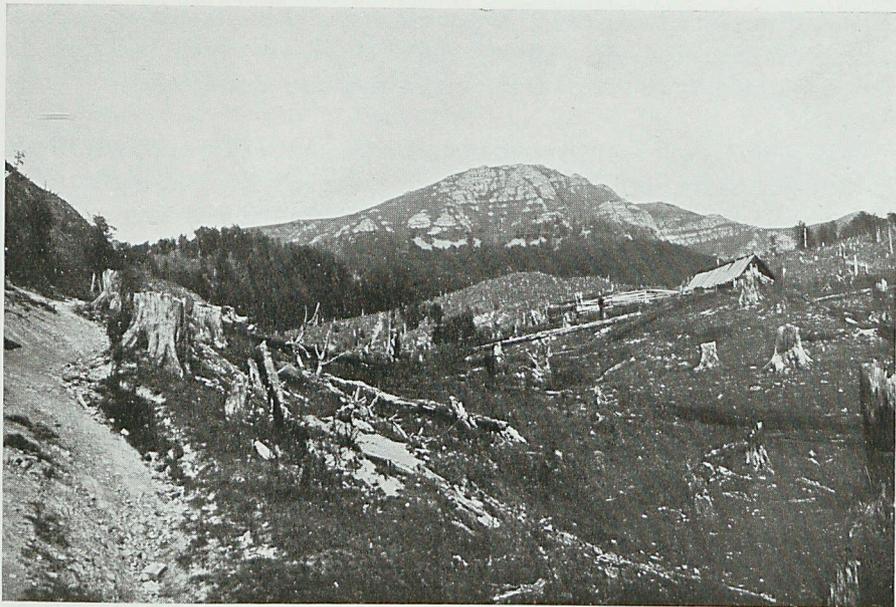


FIG. 10.

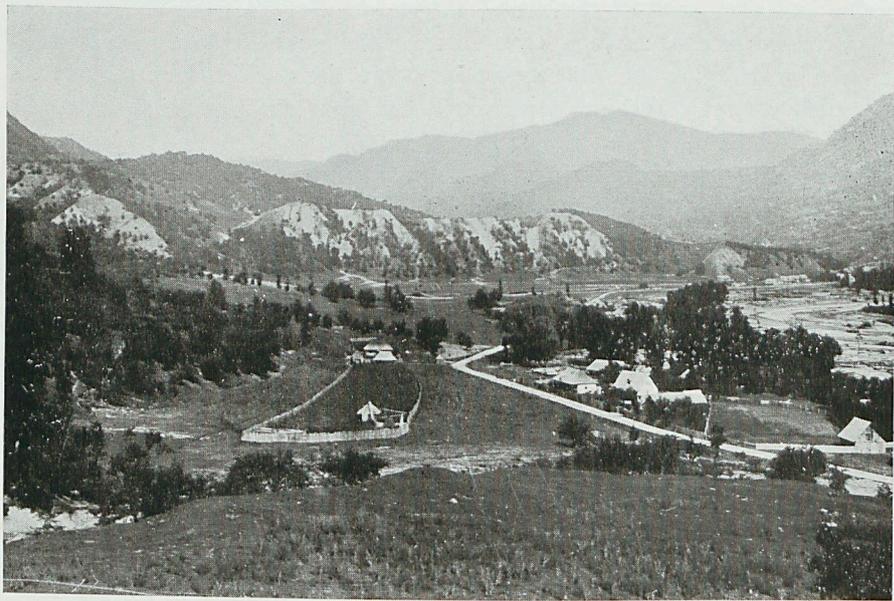


FIG. 11.

FIG. 10—Deforestation associated with pastoral life in the Southern Carpathians. In the right middle-ground a recently established *stina*, or shepherd's house; in the background the Sireu, a characteristic monadnock summit of hard conglomerates in the Moldavian flysch Carpathians near the headwaters of the Buzeu River.

FIG. 11—Transverse valley region of the Olt River; a tributary valley near the village of Titesti. Alluvial terrace with villages, fields, and orchards.

The development of such broad plains as the plains of Hatzeg, of Fogaras, and the Haromszek basin is simply the result of the rapid erosion of the soft Levantine beds. The stages of erosion are clearly shown by the terraces.⁷

The physiography of the mountains bordering the Transylvanian Basin in the east has not yet been worked out. We only know that the Hargitta is a complex volcanic mass, in which the original slopes may easily be reconstructed, and which has blocked the upper valleys of the Maros and the Olt, forming the basins of Gyergyö and Csik.⁸ It lies at the very place where one would expect to find the continuation of the Transylvanian Alps, by following the strike of the schists, and shows how much breaking and sinking is responsible for the outline of the Southern Carpathians. The Rodna Mountains are a remnant of those old masses, and appear as the duplicate of the Fogaras Mountains in the Transylvanian Alps, a bold, heavily timbered, strongly glaciated alpine chain, with cirques and small troughs.⁹

The greater part of the Moldavian Carpathians, which are built of closely folded flysch sandstones, still awaits physiographic investigation. On several reconnaissance tours I gained the impression that the highest summits, formed of conglomerates and hard sandstones, are Riu Ses monadnocks, and that most of the round ridges are derived from the maturely dissected Gornovitza surface. Interesting facts would certainly be brought to light by studying the sub-Carpathian depressions, which here may better be called intra-Carpathian depressions, for they are separated from the plains and hills of Moldavia by a belt of folded sub-Carpathian ridges.

Surrounded by mountains, the Transylvanian Basin has a dry and extremely continental climate. The winters are particularly severe in the plain of Kronstadt; the summers are exceedingly hot. A loam similar to the loess of southern Russia is found nearly everywhere on the slopes of the hills. The flora of the region called Mezöseg, north of the upper Maros River, is steppelike in character.

It is rather curious to see how the Magyars, coming from the great Hungarian plain, entered the Transylvanian Basin, followed the broad valleys with the loess terraces, and established themselves in the dry plains of Mezöseg and in the Haromszek basin, where you find their large villages and their bighorn cattle. The Rumanians, however, remain the dominating race and show such a power of expansion that they have completely assimilated many Magyar villages and nearly all German colonies. In addition they have been able to cross the mountains and contribute to the colonization of the plains of Wallachia and Dobrudja.

All that we know of the Southern Carpathians goes to show that they are very different from the Alps. The piling up of the overthrust masses

⁷ E. de Martonne, paper cited in footnote 2, pp. 213-216 and 225-227.

⁸ L. Sawicki, *op. cit.*, pp. 259-262.

⁹ *Ibid.*, p. 160.

occurred probably at an earlier time. The main physiographic features are the result of downwarping and upwarping, of partial peneplanation, and of a more or less complete dissection of old mature surfaces according to the hardness or softness of the strata.

The human geography of the area is not less peculiar than the physiography and is partially controlled by the physiographic features. Pastoral life with extensive migrations is a typical feature and may account for the preservation of the Rumanians as well as their extension over Transylvania and Wallachia.

THE NORTHERN CARPATHIANS

Geological and topographic mapping has been more completely carried on in the Northern Carpathians than in the Southern. However, physiographic investigation has only begun, and much remains to be done to understand the development of the relief.

The most striking feature is the contrast between the outer belt of parallel ridges, apparently regularly folded flysch sandstones, and the inner belt, exhibiting the most confusing alternation of isolated small massifs and more or less closed basins of highly complicated geological structure: schists and granite, Paleozoic and Mesozoic layers, flysch, and even large volcanic masses.

The outer belt may be called the Beskids. We know from borings in Wielicz that their structure is not so simple as it appears and that we have to do with overthrust masses advancing over the Neocene beds to the north.¹⁰

The physiographic studies of Sawicki¹¹ have shown how the slightly undulating surface to the south of Cracow is a peneplane of Miocene age, above which stand some monadnocks (Fig. 8). Southward the surface rises, the monadnocks become more strongly developed, making parallel ridges, while the surface continues in the form of a network of old valleys. From the statements of Sawicki one may infer that this surface was formed in the Riu Ses cycle of landform development, but it has been partially downwarped, and buried under Neocene sediments, to be exposed again by the removal of the soft beds covering it.

Whatever may be its history, this peneplane is a striking feature of the Beskids, dissected as it is by comparatively wide valleys, except where it is cut on limestones. The network of old valleys was followed by the Slav colonization coming from the north. Woods were cleared, small villages established, and little houses built here and there along the rivers or on the edges of the shoulders representing the floors or sides of the old Miocene valleys. But the woods on the ridges everywhere remain intact. There is a striking contrast between the densely timbered monadnock ridges with their com-

¹⁰ V. Uhlig: Über die Tektonik der Karpathen, *Sitzungsber. der Kais. Akad. der Wiss. Wien: Math.-Naturwiss. Klasse, Abt. I*, Vol. 116, 1907, pp. 871-982.

¹¹ L. Sawicki: Die jüngeren Krustenbewegungen in den Karpathen, *Mitt. der Geol. Gesell. in Wien*, Vol. 2, 1909, pp. 81-117.

paratively steep slopes and the smoothed surfaces covered with fields and meadows and dotted with villages and farms. Southward still farther the old Miocene surface does not rise over 900 meters (3,000 feet), and this is the reason why the inhabited zone is so low in the Beskids. The tops of the highest ridges stand only 100 or 200 meters (330 to 660 feet) above the timber line and can be used as pasture grounds in the summer. Cattle raised in the neighboring valleys are found in every suitable place. But this is nothing as compared with the extensive migrations of the Rumanian shepherds in the Southern Carpathians.

The inner belt of the Northern Carpathians, which may be called the Hungarian Alps, is the most confused part of the whole Carpathian range. Lugeon has shown that it has an overthrust structure, the detail of which has not been worked out.¹² But the topography can only be considered as the result of downwarping and faulting.

Some massifs are flat-topped and resemble the Boreseo surfaces in the Southern Carpathians; but they appear at different heights, separated by broad basins, so that only very accurate physiographic studies would yield evidence regarding the ages and the relations of such surfaces.

The highest massifs have been strongly glaciated and are bordered by cirques with large lakes, beautiful troughs, and small hanging valleys, derived from young preglacial torrential valleys. Such is the case with the Tatra, which is a true alpine chain with sharp ridges and precipitous peaks. Other massifs, such as the Nizna Tatra and the Fatra, are simply fringed by small cirques like the Boreseo ranges in the Southern Carpathians and still preserve high rolling surfaces which can be used as pasture grounds.

The basins are not directly due to downwarping and faulting. They ordinarily show a succession of terraces, of which the highest are developed in the form of an esplanade, in many cases entirely surrounding the depression and corresponding to a divide between two neighboring basins. Such esplanades are commonly built on Neocene strata, more or less faulted, or of strongly folded flysch. It seems that the basins have been recently re-excavated after having been peneplaned, like the Petroseny and other small basins of the Transylvanian Alps, probably at the time at which the Transylvanian Basin itself began to be dissected again. The sinking of the Hungarian plain may have contributed to increase the erosive power of the tributaries of the middle Danube. Some captures resulted from this process, the most striking example being the capture of the upper Arva by the Waag.

The contrast found in the Beskids between the densely populated old Miocene surface and the wooded monadnock ridges is not less striking here between the massifs and the basins. The break of slope at the contact of the

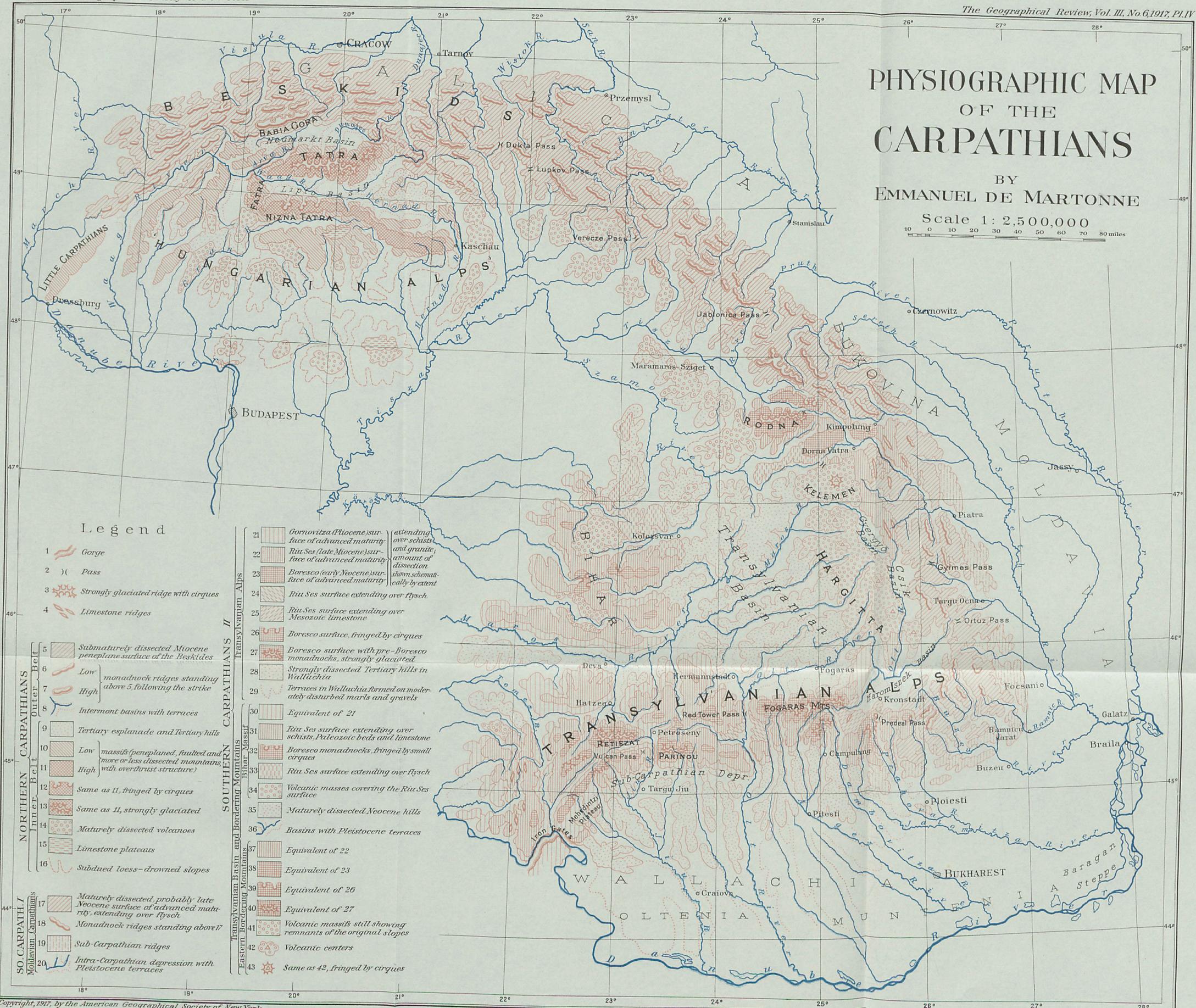
¹² M. Lugeon: Les nappes de recouvrement de la Tatra et l'origine des Klippes des Carpathes, *Bull. Soc. Vaudoise des Sci. Nat. (Lausanne)*, Ser. 4, Vol. 39, 1903, pp. 17-63.

PHYSIOGRAPHIC MAP OF THE CARPATHIANS

BY EMMANUEL DE MARTONNE

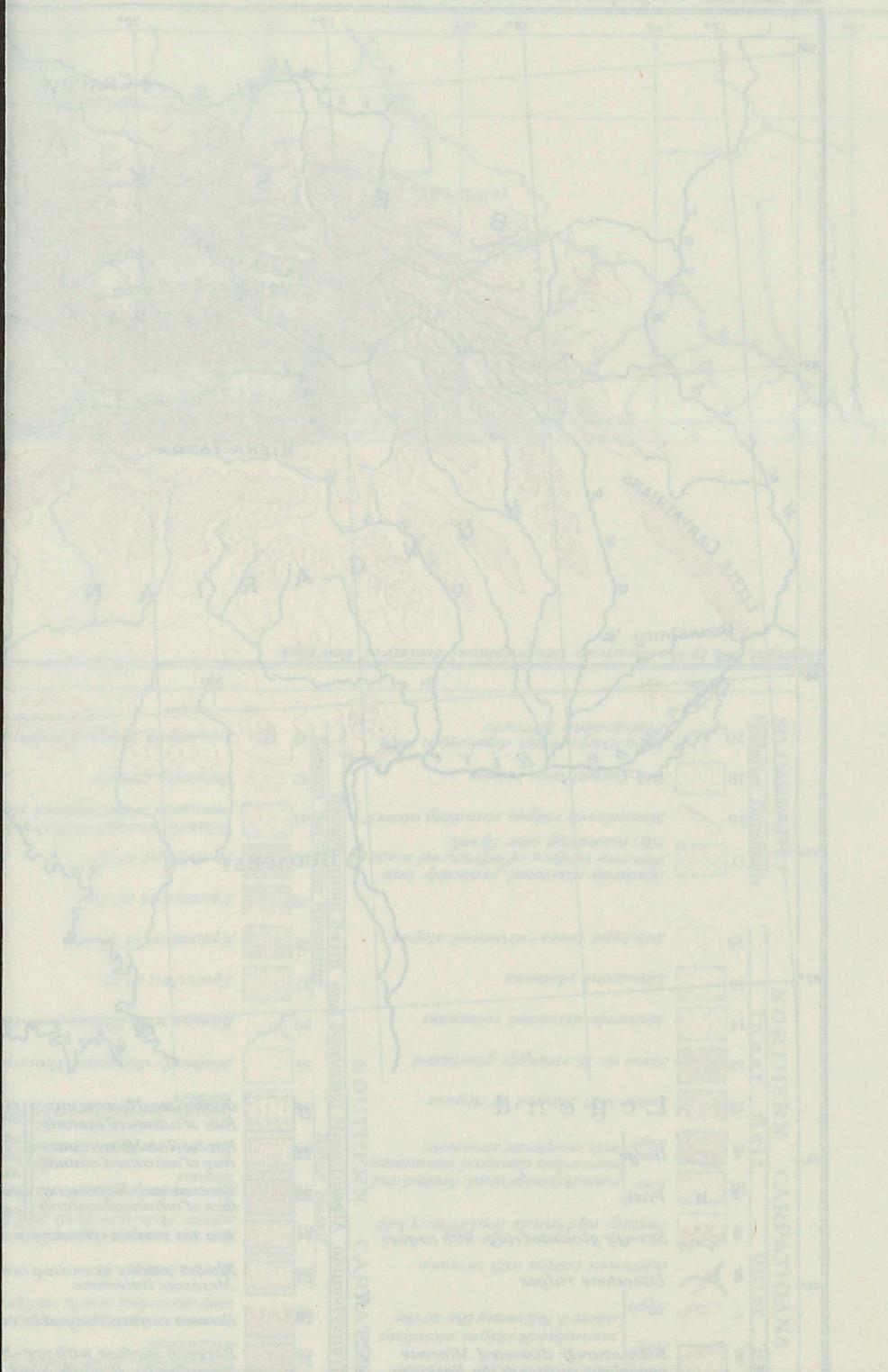
Scale 1:2,500,000

10 0 10 20 30 40 50 60 70 80 miles



Legend

- 1 Gorge
 - 2 Pass
 - 3 Strongly glaciated ridge with cirques
 - 4 Limestone ridges
- | | |
|---|--|
| <p>NORTHERN CARPATHIANS</p> <p>Outer Belt</p> <ul style="list-style-type: none"> 5 Submaturely dissected Miocene peneplane surface of the Beskides 6 Low monadnock ridges standing above 5 following the strike 7 High monadnock ridges standing above 5 following the strike 8 Intermont basins with terraces 9 Tertiary esplanade and Tertiary hills 10 Low massifs (peneplaned, faulted and more or less dissected mountains with overthrust structure) 11 High massifs (peneplaned, faulted and more or less dissected mountains with overthrust structure) 12 Same as 11, fringed by cirques 13 Same as 11, strongly glaciated 14 Maturely dissected volcanoes 15 Limestone plateaus 16 Subdued loess-drowned slopes <p>Inner Belt</p> <ul style="list-style-type: none"> 17 Maturely dissected, probably late Neocene surface of advanced maturity, extending over flysch 18 Monadnock ridges standing above 17 19 Sub-Carpathian ridges 20 Intra-Carpathian depression with Pleistocene terraces <p>SO. CARPATHIANS</p> <p>Moldavian Carpathians</p> | <p>SOUTHERN CARPATHIANS</p> <p>Transylvanian Alps</p> <ul style="list-style-type: none"> 21 Gornovitz (Pliocene) surface of advanced maturity 22 Riu Ses (late Miocene) surface of advanced maturity 23 Boreasco (early Neocene) surface of advanced maturity 24 Riu Ses surface extending over flysch 25 Riu Ses surface extending over Mesozoic limestone 26 Boreasco surface, fringed by cirques 27 Boreasco surface with pre-Boreasco monadnocks, strongly glaciated 28 Strongly dissected Tertiary hills in Wallachia 29 Terraces in Wallachia formed on moderately disturbed marls and gravels 30 Equivalent of 21 31 Riu Ses surface extending over schists, Paleozoic beds and limestone 32 Boreasco monadnocks, fringed by small cirques 33 Riu Ses surface extending over flysch 34 Volcanic masses covering the Riu Ses surface 35 Maturely dissected Neocene hills 36 Basins with Pleistocene terraces 37 Equivalent of 22 38 Equivalent of 23 39 Equivalent of 26 40 Equivalent of 27 41 Volcanic massifs still showing remnants of the original slopes 42 Volcanic centers 43 Same as 42, fringed by cirques <p>Bihar Massif</p> <p>Transylvanian Basin and Bordering Mountains</p> <p>Eastern Bordering Mountains</p> |
|---|--|



SOUTHERN CAROLINA

1	Granite
2	Quartzite
3	Schist
4	Gneiss
5	Amphibolite
6	Quartzite
7	Schist
8	Gneiss
9	Amphibolite
10	Quartzite
11	Schist
12	Gneiss
13	Amphibolite
14	Quartzite
15	Schist
16	Gneiss
17	Amphibolite
18	Quartzite
19	Schist
20	Gneiss
21	Amphibolite
22	Quartzite
23	Schist
24	Gneiss
25	Amphibolite
26	Quartzite
27	Schist
28	Gneiss
29	Amphibolite
30	Quartzite
31	Schist
32	Gneiss
33	Amphibolite
34	Quartzite
35	Schist
36	Gneiss
37	Amphibolite
38	Quartzite
39	Schist
40	Gneiss
41	Amphibolite
42	Quartzite
43	Schist
44	Gneiss
45	Amphibolite
46	Quartzite
47	Schist
48	Gneiss
49	Amphibolite
50	Quartzite

SOUTHERN CARPATHIANS

1	Granite
2	Quartzite
3	Schist
4	Gneiss
5	Amphibolite
6	Quartzite
7	Schist
8	Gneiss
9	Amphibolite
10	Quartzite
11	Schist
12	Gneiss
13	Amphibolite
14	Quartzite
15	Schist
16	Gneiss
17	Amphibolite
18	Quartzite
19	Schist
20	Gneiss
21	Amphibolite
22	Quartzite
23	Schist
24	Gneiss
25	Amphibolite
26	Quartzite
27	Schist
28	Gneiss
29	Amphibolite
30	Quartzite
31	Schist
32	Gneiss
33	Amphibolite
34	Quartzite
35	Schist
36	Gneiss
37	Amphibolite
38	Quartzite
39	Schist
40	Gneiss
41	Amphibolite
42	Quartzite
43	Schist
44	Gneiss
45	Amphibolite
46	Quartzite
47	Schist
48	Gneiss
49	Amphibolite
50	Quartzite

SOUTHERN CARPATHIANS

1	Granite
2	Quartzite
3	Schist
4	Gneiss
5	Amphibolite
6	Quartzite
7	Schist
8	Gneiss
9	Amphibolite
10	Quartzite
11	Schist
12	Gneiss
13	Amphibolite
14	Quartzite
15	Schist
16	Gneiss
17	Amphibolite
18	Quartzite
19	Schist
20	Gneiss
21	Amphibolite
22	Quartzite
23	Schist
24	Gneiss
25	Amphibolite
26	Quartzite
27	Schist
28	Gneiss
29	Amphibolite
30	Quartzite
31	Schist
32	Gneiss
33	Amphibolite
34	Quartzite
35	Schist
36	Gneiss
37	Amphibolite
38	Quartzite
39	Schist
40	Gneiss
41	Amphibolite
42	Quartzite
43	Schist
44	Gneiss
45	Amphibolite
46	Quartzite
47	Schist
48	Gneiss
49	Amphibolite
50	Quartzite

massifs and the basin floors is emphasized by a change in the vegetation. A dense forest of fir and beech trees covers the mountain block. On the esplanade, where the light oak forest has been cleared, pasture grounds and some fields occur; but the bulk of the cultivated and inhabited zone is found in the basins. There are a few points in the mountains where the forest has been cleared and settlements of German mining colonies are found at heights of about 1,000 meters (3,300 feet). The highest basins, such as the Neumarkt basin to the north of the Tatra and the Lipto basin to the south, were late in being settled; here Germans founded small towns and built a dense network of agricultural villages. The scattered villages of the Slavs, on the other hand, everywhere occupy the lowest parts of the basins, with fields extending over the terraces. A map of the density of population would emphasize the distinction between the mountain blocks and the basins and would at the same time be a good orographic map.

The southernmost part of the Northern Carpathians is the most shattered. Extensive volcanic masses have been poured out since the early Miocene, covering almost entirely the few remnants of the old folded mountain range. The whole area appears to have been partially drowned by the sinking of the Hungarian plain. Instead of nearly enclosed basins, with terraces, we find broad, open depressions rising by continuous slopes to flat domes.

The dry climate of the plain, marked by clear days, affects the whole region. Dark brown or black soils are found on the lower parts, and the loess extends up to a height of 400 meters (1,300 feet) on the gentle slopes. The Magyars are here as much at home as in the Alföld, the great Hungarian plain. One cannot fail to remark the contrast their large villages make with the small scattered houses of the Slav peasants. They cultivate more wheat, have more cattle, and especially large herds of swine. Vineyards cover the southern slopes.

The range here is more widely open; it almost vanishes in the plain.

CONCLUSION

The Carpathians may hardly be considered a geographical unit, in contrast to the Alps, which stand as a bold and solid mass, though a large area in the west was drowned in the plain of the Po, and downwarped or faulted basins fringe the eastern extremity, facing the Hungarian plain.

Not so with the Carpathians. They are a much-shattered mountain system, and this shattering seems to have begun very early. The Transylvanian Basin, with its great extent of Neocene layers, was certainly formed just after the first uplift of the range, and probably looked, in late Neocene time, much as does at present the great embayment of the Hungarian plain near the headwaters of the Tisza, by which the Carpathian bow is almost completely broken in two.



FIG. 12.



FIG. 13.

FIG. 12—Decorated entrance to a house in the village of Bumbesti, sub-Carpathian depression of Targu Jiu. Dwelling on the right, stable on the left, orchard in the background.

FIG. 13—House in the village of Bumbesti.

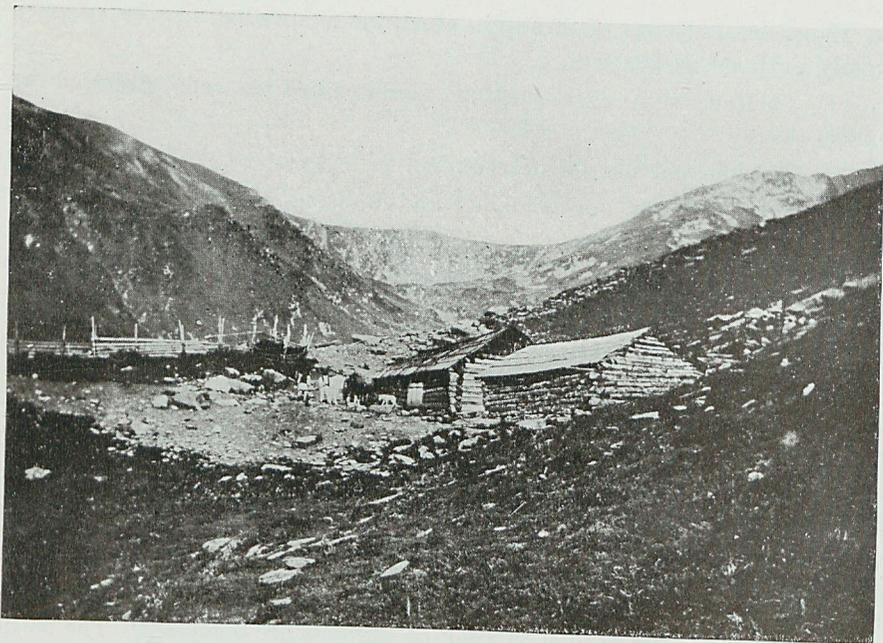


FIG. 14.

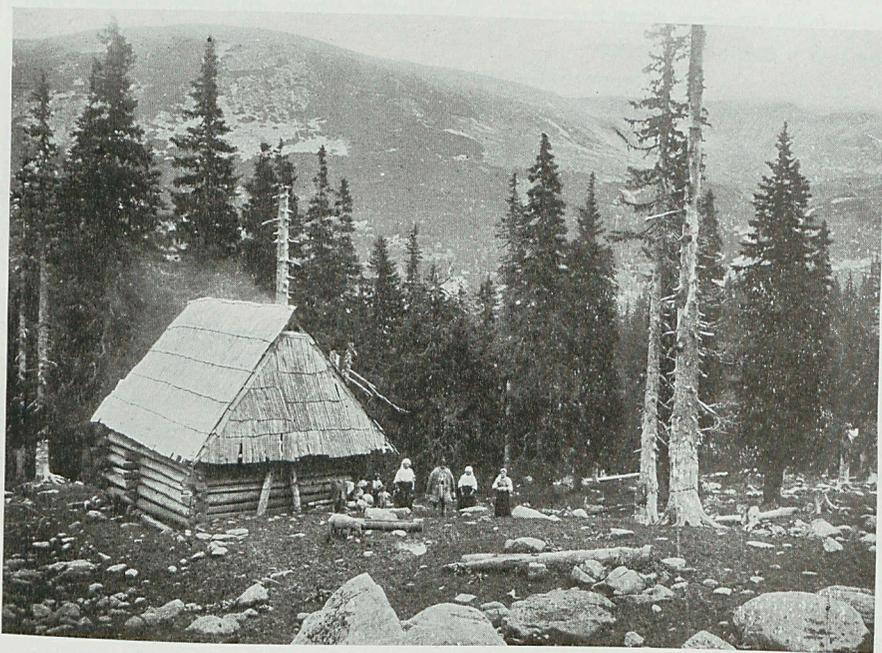


FIG. 15.

FIG. 14—Pastoral life in the Transylvanian Alps: a *stina*, or shepherd's house, in the Fogaras Mountains above timber line. Sheep corral on the left, cheese hut on the right.

FIG. 15—Pastoral life in the Transylvanian Alps: a *stina* near the timber line, Paringu massif.

The general scheme of evolution of alpine mountains may be approximately outlined as follows:

- (1) Folding, with overthrusting, accompanied or soon followed by uplift.
- (2) Erosion and partial or complete peneplanation.
- (3) Shattering, by downwarping and faulting, of more or less extensive parts of the mountains.
- (4) Uplift accompanying or following the shattering, with erosion and more or less extensive glaciation.

The physiographic features depend chiefly upon the relative importance of these episodes and upon their more or less close succession.

In the Alps the succession has been a very rapid one, so that it is difficult to discern the features due to each episode. The special importance of the last episode has been recognized only in recent years. Uplift is more important than stream erosion.

The development of the Carpathians was slower. Shattering was more important than uplift. The result is that we can recognize much better the forms due to the successive cycles of erosion, especially in the Transylvanian Alps. Flat-topped or subdued summits are dominant. The mean height is very great compared with the maximum height of each massif. Only local glaciers were formed in Pleistocene times, and true alpine ridges are not a common feature.

As a whole, the Carpathians are an open mountain system, with wide, old valleys, as for instance in the Beskids; many small basins, as in the Hungarian Alps and in some parts of the Transylvanian Alps; extensive basins, as the Transylvanian Basin; or even great embayments of the plain penetrating into the very heart of the mountains, as the upper Tisza plain.

The influence of these features on the biogeography and human geography of the region is very apparent.

The subalpine and alpine flora of the Southern Carpathians is in many respects different from the flora of the Northern Carpathians. As a whole the Carpathians are not so heavily timbered or so densely inhabited as the Alps. But while the mean of the uninhabited surface is probably about 60 per cent in the Alps, it is certainly less than 50 per cent in the Carpathians. Man does not need to climb so high; wide valleys or basins are everywhere open to settlement.

The Alps were not able to check the advance of the peoples invading Europe, but they deflected the waves of the invaders to the north and to the south. They have been penetrated by the Slavs and the Germans, though they still form the limit of various languages and nationalities.

The Carpathians not only have been crossed by invaders on various occasions, but, instead of playing the rôle of a wall separating different

peoples, they have served as the center of development of certain nationalities. This is particularly true of the Southern Carpathians, in which we find the citadel of the Rumanians.

In the present great war, the Carpathians, standing between the two groups of belligerents, have been crossed at the north by the Russians and at the south by the Rumanians invading Transylvania and by the Austro-Germans invading Rumania.

The reader is not to gain the impression that the writer believes all features of human geography to be controlled by physiographic conditions. A complete study of the human geography of the Carpathians would involve many considerations that it is not the intention of the writer to present here, and particularly much history. Physiography affords possibilities which are realized by man in varying degree. Certainly there are in the Carpathians some remarkable evidences of the control exercised by the physiographic features upon the development of human activity. Nevertheless the writer does not wish to imply that this human activity developed as it did merely because of what the physiographic history of the range has been, but rather that it could not have been what it is if the range had been built otherwise.

