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The Danube

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which was already sufficiently open to be easily habitable by neolithic man, but ceased at the point where forests became dense enough to impede further progress. I believe I am right in interpreting Mr. Wace's record, in the sense that these settlements are settlements of cattle-using folk, and if so, it is pretty clear that anything like thick woodland would offer an almost insuperable bar to the extension of that mode of life. I refer, of course, to the kind of thing which is happening persistently all along the slopes of the great equatorial highlands of Africa, where pastoral life is only practicable above a certain altitude, and tribes are only driven down into tropical jungle, if for any cause they lose their cattle.

A further point is this, that in the forest there are the trees themselves for timber, which, as Mr. Wace has pointed out, is the primary material for any kind of permanent shelter there. That is to say, within a forest area, habitations are likely to be timber habitations, and such huts, if they burn or decay, leave practically no trace behind them. It is only outside the area of dense forest, in drier and more open and comparatively treeless areas, that (in the absence of timber) there is more "daub" and less "wattle" in the construction of the houses. Under those circumstances, you will see that the amount of *débris* on a particular site will vary according as that site itself is within the timber area or is out on the timberless grassland. The only qualification which I should add is this, that we should wish to be assured of the extent to which nomadism, of the kind which Mr. Wace has indicated as one of the habitual modes of life in that region, is associated with abstinence from permanent settlements of stone or mud brick; or how far, as I think I am right in assuming from what he said, nomadism of the kind of which he has indicated is compatible with stone houses at the top end of the seasonal orbit of the nomads, and perhaps also at the lower end as well. That is one fresh point which it occurs to me to suggest for consideration by Mr. Wace and his colleagues.

Meanwhile I should like, in your name, to thank Mr. Wace and Mr. Thompson for the paper they have given us.

MR. A. J. B. WACE: I do not think I have really anything to say. I should really make an apology to you for having covered such a wide area in my paper. As regards the neolithic habitation of the western part of the Thessalian plains, we have been three times in that portion of the plains; we have carefully searched the plains ourselves, as well as inquired of the peasants whether there are any mounds. We have visited several presumed mounds that we could see in the distance, and found them not to consist of prehistoric *débris*, but of lumps of limestone. I do not think there are any prehistoric mounds in that region, and I can see no reason why, if there had been, they should have disappeared in the western part and not in the eastern, because it is all one plain, rising very slightly as it goes up to the hills. The climatic conditions are exactly the same.

THE DANUBE.*

By EDUARD SUESS.

BETWEEN the four great mountain strongholds of Austria-Hungary—the Tirol, Bohemia, Siebenbürgen, and Bosnia—the Danube, the greatest river of this

* Abstract of address delivered by the President of the Vienna Academy of Sciences on the occasion of the Jubilee of the Archduke Rainer as its Curator.

continent, rolls its flood. To the question, where does it rise? the school-books give answer, "at Donau-Eschingen, in the Grand Duchy of Baden." But the case is not so simple. Two head-streams, the Brigach and the Brege, flow down from the primitive highlands of the Black Forest, and, uniting at Donau-Eschingen with the spring which rises at its castle, thenceforth take the name of Danube. But after a course of 12 miles the volume of the stream declines, and in time of drought—often for three or four months in succession—the upper or Black Forest Danube disappears. Eight miles to the south, at a level lower by 560 feet, the stream reappears as the Aach, and enters the Lake of Constance at Radolfzell. It thus comes about that just that part of the upper Danube which remains in existence at low water finds its way, not to the Black sea, but through the Lake of Constance to the Rhine and the North sea. Only below Friedigen, in the neighbourhood of Beuron, is water again collected in the bed of the river, and it may thus be held that the Danube, as a permanent stream, rises not in Baden but in Württemberg.* Flowing on with a fairly rapid fall towards Ulm, the Danube reaches a spot where an exactly opposite state of things may once have prevailed. In the Schussental, which runs south to the Lake of Constance near Friedrichshafen, the water-parting towards the Danube is formed by a recent moraine, and the possibility is therefore suggested that in former times the Lake of Constance may have found an outlet by this valley to the Danube, the junction with which would have taken place a little above Ulm. In this case the water-supplies of a considerable part of the Swiss Alps would be taken from the Rhine and added to the Danube.

We have now reached the Bavarian plain, with a slope to the north which pushes the stream in the same direction, causing it to impinge on the spurs of the limestone massif of Franconia. Ingolstadt was formerly not on the Danube, which has only in later times broken away through the rocky pass near Neuburg. It is a natural question to ask why the Danube has opened this passage through the limestone massif when a much easier way lay open to it. The question becomes still more insistent as we near the Austrian frontier, where, though a course was open to the river by Braunau and Wels, and along the foot of the northern mountains past St. Pölten, it has not followed this, but has forced a way into the hard granite and gneiss of the Bohemian massif above Passau, and, cutting a deep channel in these, remains confined for the most part within a rocky bed as far as the eastern border of the Bohemian primitive mass near Krems. It has cut off whole sections of this, which, like the heights south of Linz and the rock masses of Melk and Göttweih, rise aloft on its right bank. Further, not only have its left-bank tributaries cut themselves channels in the primitive rocks, but even on its right bank some of its tributaries (*e.g.* the lower courses of the Vils and Inn) have, like itself, left the plain to enter the mountains. Thus, not the Danube only, but a section of its whole system has stamped its impress from above on the old mountain mass, and cut down into the same. Such valleys and valley-systems are known as epigenetic. In this part of the Danube's course the sandstones and limestones of the southern massif (the Alps) stand in strong contrast to the granite and gneiss of the northern (the primitive mountains of Bohemia); the latter falling southwards towards the former. Now the primitive massif bears traces of more recent marine deposits of white sand, which extend to a considerable height above the Danube; and, further, we find on it, up to a height of 1500 to 1600 feet, rocks whose place of origin was certainly in the Alps. The conclusion, therefore, is that the present form of the plain dates from recent times.

* On the Danube-Rhine connection here alluded to, see *Journal*, vol. 31, p. 440.

At Krems we leave the primitive zone and soon reach the narrows of Klosterneuberg, where the Danube crosses the outer or sandstone zone of the Alps. Here the case is not so much that of a sawing through, as of an actual sinking of a portion of the Alps. In this way the intra-Alpine basin of Vienna took shape. Here the Danube receives a large amount of underground water which has been collected from the fissured region about Neustadt and elsewhere. Most of it finds its way to the Danube near Fischamend, where it assumes quite the character of a dead branch of the river; and having, as is usually the case with ground-water, a nearly constant temperature some 16° Fahr. above the freezing-point, it creates a winter harbour for shipping almost entirely free from ice.

The course of the Danube has often been compared to a rope stretched horizontally, the points at which it is fixed or supported being represented by the rocky defiles. Between these it shows a marked tendency to deviate to the right, as *e.g.* between Leopoldsberg and Theben. In Hungary this deviation to the right becomes still more marked. The long rocky pass between Gran and Budapest forces it to bend through a right angle, and it takes a southward direction for a long distance. The Drave, with its higher right bank, now enters from the west, the two streams meeting at a right angle. But the Drave, thanks to its elevated bank, gains the mastery, and compels the Danube to assume its own direction. The heights of Belgrade determine the direction, not only of the Danube, but of the lower course of the Save. This deviation to the right, which is particularly marked in the case of the Siberian rivers, is, as was first shown by Von Baer, a result of the rotation of the Earth.

Much more might be said as to the physical character of the Danube, but some attention must be paid to Man's appearance and activity in the valley of the great stream. We find him already present, long before the dawn of historical chronology. To meet with the earliest known traces of his presence we must ascend the Save valley, where, near Krapina in Croatia, they exist in association with rough stone implements and an extinct species of rhinoceros. Man of that time was a strange-looking being, with retreating chin and processes of bone over the eyes. More recent, but on the far side of all existing history, are the human remains of the loess, *e.g.* in the neighbourhood of Krems. Of still later date are the inhabitants of the pile-dwellings, such as we find on the Laibach moor and on the south side of the Neusiedler-See; such dwellings date back to the middle of the first millennium before our era. To the same period may perhaps belong the traces of an advanced civilization, assignable to the so-called Hallstatt era, which some have considered indigenous, others, to have been imported from Northern Italy.

The Romans now appear on the scene. From Bavaria to far beyond Carnuntum the right bank of the Danube is marked with remains of the "limes"—the series of fortifications, camps, and watch-towers by which the Roman emperors guarded this section of the frontier. They were linked together by a military road. In the uppermost section of the rock-valley of the upper Danube legend has it that Kriemhild was brought to King Attila. The armies of Charlemagne, too, passed by this route, marching, probably, along the remnants of the Roman *limes*. Along the Danube, too, a large part of the Crusaders took their way, and by the same road did Rudolf of Habsburg enter the land. To Christendom the Danube formed a main line of communication, as is witnessed by the noble religious edifices which rise above its banks. Ebelsberg, with its memories of the sanguinary fight at the Traunbrück, reminds us that Napoleon too used this route. Coming to the mouth of the Enns, we find the small village of Lorch, representing Laureacum, the headquarters of a part of the

second Roman legion, and of the flotilla of the Danube. Here, in the year 303, St. Florian suffered martyrdom in the Enns. Hence St. Rupert sallied forth to found Salzburg. But its glory has departed, and the metals of the Kaiserin-Elizabeth railway pass through what was once the camp of the legion.

Once more we enter the rock-valley and pass on to the lovely Wall-See, to the whirlpool of Grein (the *hospitium mortis* of an old historian), and to the romance-girt ruins of the Aggstein and the Dürnstein, finally leaving it between Krems and Göttweig. Greeted by the newly-restored battlements of Castle Kreuzenstein, and passing the slopes of Nussdorf and the field which saw the great slaughter of the Turks, we reach Vienna. Through the very centre of the city runs the scarped right bank of the river, formed under the influence of the Earth's rotation, on which stood the northern front of Vienna's fortifications from Roman times to within the nineteenth century, and which is to-day crowned by the church of St. Rupert. A long, straight, and stony strip with scanty growth of grass comes into view, and we find ourselves on the Franzosenstrasse. Beyond, on the left, extend the green flats of the lower March, and still further on, to the right, we see the ruins of Carnuntum, the proud predecessor of Vienna. By the pass of Theben we reach Pressburg, and passing in succession Komorn—the fortress which bars the passage of the Danube—Visegrad, and the cathedral of Gran, come to the fine city of Budapest. Crowds of recollections throng upon us. We pass Mohács and the fortifications of Belgrade, and soon have beside us the famous work of Trajan's legions—the remnant of the Roman road which is our companion through the defile of the Iron Gate. Last of all, at the extreme southern limit of Hungary, comes the little valley over against Orsova, where on native soil the crown of St. Stephen waited not in vain the hour of restitution.

In conclusion, let us return once more to the headwaters of the great stream, and note the importance in its economy of the contributions brought by the Inn from the melting snows of the Alps. And as the drops which trickle from the margin of one of these Alpine snowfields unite to form rivers which find their way by different routes to the Black or North seas, so is it with the thoughts of men. Obscure as these are in their origin, and diverse in the course they pursue, great achievements result from the converging efforts of a multitude of individuals, differing in nationality but united in one common aim. The monument in the Singerstrasse at Vienna reminds us how the Emperor Maximilian banished barbarism from Germany. This takes us back four centuries, to the time of Konrad Celtes and the "Society of the Danube" of which he was the heart and soul, and in which the first organized effort at International Union took shape.

REVIEWS.

EUROPE.

BRITISH WATERWAYS.

'Royal Commission on Canals and Waterways.' Vols. 8-10. London: Wyman & Sons. 1910.

THE final Report of the Commissioners, as embodied in vol. 7, was reviewed in the *Journal* for May, 1910. Vols. 8, 9, and 10 have now been issued. Vol. 8 consists of appendices to the fourth and final Report, and deals with a variety of matters, such as relative cost of transport by rail and water in different