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THE WELLE PROBLEM.

BY J. DE JANKÓ, JUN., OF BUDA-PESTH.

IN consequence of the zealous exploration carried on in Africa during the present century, the appellation *terra incognita*, so long used to designate that continent, is now only applicable to the small portion of territory lying between the sources of the Nile and the Shari, and the Congo north of the equator. This region is watered by the Welle, whose course is only known to the east of the 22d meridian. Its lower portion is still unexplored. The determination of the outlet of this river is the Welle problem.¹ Where does it discharge its waters—into the Shari, the Congo, or elsewhere?

The first European to set eyes upon the Welle was Dr. Schweinfurth,² who, agreeably to the state of geographical knowledge at that time, considered it as belonging to the Shari. His main reason for this conclusion was that the great volume of water in the Shari, as observed by Barth,³ Nachtigal,⁴ and others, could only be explained by the existence of some considerable tributary such as this. The water of the Shari, however, is highest when that of the Welle is lowest, namely in March, notwithstanding that the current of the Welle is of sufficient velocity to be able to traverse the distance between the nearest observed points of the two rivers in the space of twenty-two days. Consequently the Welle cannot belong to the system of the Shari. Since Dr. Schweinfurth first visited this region our knowledge of it has very largely increased, and he has now, in the light of this newer information, abandoned his former theory as to the issue of the river, and subscribed to Wauter's view.⁵ The identity of the Welle and the Shari is still maintained by Duveyrier.

The lifting of the veil from the course of the Congo has also thrown a different light upon the problem of the Welle. Stanley discovered below Stanley Falls a large river, the Aruwimi,⁶ which he subsequently ascended⁷ for a distance of 90 miles, and which, on its discovery, he identified with the Welle. After this the Welle was separated from the system of the Shari, and assigned to that of the Congo. This still left the great volume of the Shari unaccounted for. Succeeding explorers of the Congo—Hanssen and Grenfell⁸—discovered several large right-hand tributaries of the Congo, such as the Itimbiri or Ukere, and the Ubangi. These two streams have therefore been brought in to play a rôle in con-

¹ Baumann, "Die Uelle-Frage," *Mitt. k. k. Geogr. Ges.*, Vienna, 1885, p. 342.

² Schweinfurth, *In the Heart of Africa*, vol. i. ch. xii.

³ Barth, *Reise in Central Africa*, vol. ii. p. 64.

⁴ Nachtigal, *Sahara und Sudan*, chap. *Der Tsad*.

⁵ *Verhandl. Ges. Erdk.*, Berlin, 1887, vol. xiv., No. 3.

⁶ *Through the Dark Continent*, Asher's edition, vol. iii. p. 354.

⁷ *Der Kongo*, vol. ii. p. 132.

⁸ *Journ. Manchester Geog. Soc.*, 1886, vol. ii., No. 1, p. 87.

nection with the Welle problem—Chavanne¹ identifying this river with the former, and Wauters² and Junker³ with the latter.

Besides these, there are other bold hypotheses in the field. One of these, that of Andree and Scobel,⁴ assigns the Welle neither to the Congo nor to the Shari, but makes it flow into an inland lake without any outlet, which lies, according to Ravenstein, in about 3° N. lat. and 25° E. longitude. Another hypothesis, which owing to its want of critical acumen seems like a survival of the Middle Ages, is due to Lacroix,⁵ who holds that the Welle pours itself, not into Escayrac's Koei-Dabo lake, lying sixty days' journey south-west of Massena, but into Lake Liba, from which issue two arms, one going to the Benue, whilst the other reaches the Ogowe. The exploration of the northern tributaries of the Congo has also shown Heawood's hypothesis⁶ that the Welle, after a course of 1250 miles, joins the Cross or Old Calabar river, to be untenable.

Summing up these various theories, we seem to be justified in concluding (1) that the Welle, taking into account the rise and fall of its stream, cannot belong to the Shari (Schweinfurth); (2) that it cannot issue into an enclosed lake, for portions of the Welle are known to the west of the geographical position in which the lake in question—that of Andree and Scobel—is supposed to be situated; (3) that it cannot flow into a lake which sends one arm to the Benue and another to the Ogowe, since in that case these arms would have to cross the northern affluents of the Congo and the Ubangi (Lacroix); (4) that, for the same reason, it cannot join the Old Calabar, although this last is large enough to render Heawood's hypothesis probable; (5) that it cannot enter the Aruwimi, for in that case the Welle would have to bend round suddenly from a westerly to a south-easterly direction, as well as to break through a mountain chain, the direction of the Aruwimi, moreover, so far as its course is known, is from east to west with a very slight deflection to the south-south-west (Stanley); (6) that it cannot be identified with the Ukere, at least not in conjunction with the Werre and the Kuta-Mbomu, for that would necessitate these two streams making an exceedingly wide curve to the south-west, and the volume of the Itimbiri (Ukere) is not commensurable with the united volumes of all the rivers in question; (7) that it can hardly pour itself into the Mongalla, since this latter is considerably the smaller in volume (Hanssen).

(8) The eighth hypothesis, that of Wauters, which has the support of Schweinfurth and Junker, makes the Welle identical with the Ubangi. We may remark parenthetically that Delgeurs⁷ claimed to be the original

¹ *Afrika's Ströme und Flüsse*, p. 130.

² *Mouvement Géographique*, 1885, May 31.

³ *Verhandl. Ges. Erdk.*, Berlin, 1887, vol. xiv., No. 3.

⁴ *Karte von Africa*, 1 : 10,000,000, 1884.

⁵ *Bull. Vn. Géogr.*, Lille, 1881, p. 31.

⁶ *Roy. Geog. Soc.*, London, 1884, p. 33.

⁷ *Bull. Soc. Roy. Géogr.*, Antwerp, 1885, vol. x. No. 3, p. 150.

author of this theory. It must be conceded that, according to the latest information furnished by Junker, the Welle, so far as its direction is concerned, may go to join the Ubangi, also that the rise and fall in the respective volumes of the two rivers agree quite well. Nevertheless we cannot accept this coincidence in the matter of volume as a *sine qua non*. At the point where Schweinfurth first came upon the Welle, it had a width of 800 feet, a depth of 12 to 15 feet, and a current of extraordinary velocity. If now the Werre, a river of the same magnitude as the Welle, and the Kuta-Mbomu, which is of still greater magnitude, added their waters to those of the Welle, the united stream ought to be at least 2500 feet wide, and from 12 to 16 feet deep. This argument takes no account of the fact that the Welle increases rapidly in volume between the point at which Schweinfurth first saw it and the confluence of the Werre and the Kuta-Mbomu. The Ubangi, at the furthest known point of its course, that nearest to the united Welle-Werre-Kuta-Mbomu, is only 1800 feet wide, and from 14 to 16 feet deep; it cannot therefore be identified with the Welle.

That this feature of the question escaped the notice of both Schweinfurth and Junker seems to be due to the fact that neither of them has studied the data relating to the Welle basin so thoroughly as Ravenstein and Habenicht have done. Before proceeding to sketch the hydrographical features of this region, we must first dwell a little upon the history of discovery in connection with the basin of the Welle.

The first explorer to penetrate to this basin was Piaggia,¹ who visited the region as early as 1863. But Schweinfurth was the first traveller to give any authentic information about the river Welle itself. In the years 1876-77 the Greek physician Potagos was travelling in this same region. His information is, however, somewhat uncertain. He discovered a river named the Berre, which, according to the statements of native informants, flowed towards the west, and joined the Kuta-Mbomu; this river Potagos identified with the Welle. Over against the confluence of the Berre with the Kuta-Mbomu lay the George Mountains.² It is now conclusively established that the Berre of Potagos is identical, not with Schweinfurth's Welle, but with Miani's Werre,³ a stream which Miani again concluded to be one and the same with the Welle.

Leaving out of consideration for the moment Junker's latest reports, the knowledge we already possess of the Welle system may be summarised as follows. The region to which that system belongs is wedged in, as already stated, between the three rivers, Nile, Shari, and Congo. The really important factors of the problem are the actual basin of the river Welle itself, and the northern tributaries of the Congo. Going northwards from the banks of the Congo towards the Nile, the traveller would

¹ *Della Riva fra i Niam-Niam*, Lucca, 1877.

² *Dix Années de Voyages dans l'Afrique, etc.*, Paris, 1885, vol. i.

³ *Le Spedizione alle Origine del Nilo*, Venice, 1865.

have to cross four rivers all flowing for the most part from east to west, namely, the Nepoko, Welle, Werre, and Kuta-Mbomu.

The Nepoko originates between 29° and 30° E. long., and 2° and 3° S. lat., flows south-westwards, and joins the Congo north of Stanley Falls. Junker has touched its banks at two points, and Stanley has during the course of the year 1887 followed it up to its sources. The former traveller also mentions two northern affluents of the Nepoko, the Obe, which he himself saw, and the Nava, which he only knows from oral information of the natives.¹

The Welle is formed by the union of two large feeders, the Dangu and the Kibali-Kibbi. This last, rising in the Blue Mountains that overlook Lake Albert from the west, takes at first a northerly direction; then, after bending round towards the north-north-west, it joins the Dangu near the line of 28° E. long. Its total length may be set down at from 205 to 220 miles. Casati travelled parallel to its course at only a short distance from its bank. Junker and Emin Pasha have explored the country about its head-waters. The Dangu, which has its origin in 4° N. lat. and 30° E. long., after making a southerly bend, flows towards the west, receiving on its way the Garamba and the Akka. The united stream, under the name of Welle or Makua, rolls on in a prevalent westerly direction, coinciding generally with 4° N. lat. Its most important tributary from the south is the Majo-Bomakandi, which is itself augmented by the Makongo, Pokko, and Telli.

The Werre is fed by numerous springs in the Ndoruma Mountains, and runs successively west, south-west, and west. The furthest point that has been reached on the banks of this river is Ingimma, where Potagos turned back. The Werre has no tributaries of any consequence.

The fourth river, the Kuta-Mbomu, likewise issues from the Ndoruma Mountains, its highest point being in 23° E. long. It maintains a persistent westerly flow, and is joined by some large tributaries from the north.

That portion of the Congo which is concerned in the Welle problem is the northern loop between Stanley Falls and Equatorville. Along this part of its course its current is swollen by the addition of three large tributaries—the Aruwimi, the Itimbiri, and the Ubangi. The first of these three, which joins it in 1° N. lat. and $23^{\circ} 45'$ E. long., is now known throughout its whole distance. From Stanley's latest letters it is evident that it is no other than the Nepoko. Although 1585 yards wide at its mouth, it contracts higher up to a width of only 910 yards; but still higher up, in consequence of the presence of several islands, it expands to 1400 yards wide. Above the islands it maintains a tolerably uniform width of 800 yards. Some sixty miles lower down, in 2° N. lat. and 23° E. long., the Congo receives the Itimbiri, which comes from the north-east, about 150 or 160 miles of its course being known. Early in its

¹ *Peterm. Geog. Mitth.*, 1884, vol. xxx. p. 96.

descent it forms the rapids of Lubi, where it narrows to 195 yards wide, and shallows to some 10 or 12 feet deep; lower down it swells out to a width of 750 to 850 yards, and a depth of 12 to 16 feet. The third tributary of the Congo along this portion of its course, the Ubangi, joins it south of the Equator. It has been ascended for a distance of 600 to 650 miles, as far as $20^{\circ} 20'$ E. long. and $4^{\circ} 30'$ S. lat. At this point navigation is prevented by the rapids; the river has there a width of 660 yards and a depth of $19\frac{1}{2}$ feet; and thence the current runs south-west, then south, following the 18th meridian for a distance of about two degrees of latitude.

Before adding a ninth hypothesis to the eight already ventilated above, we must first consider the results of Junker's last journeys, and compare his map with those of Ravenstein and Habenicht. In doing this, however, we feel bound to state that we are far from desiring to detract from the very valuable labours performed by this enterprising traveller.

On Junker's map the delineation of the river Congo differs very considerably from that shown on Ravenstein's and Habenicht's maps. On the first the Congo is made to touch 20° E. long. to the south of the second parallel north of the Equator; on the last two it touches the same meridian to the north of the same parallel. Compared with Habenicht's trustworthy map, that of Junker represents Iringi, on the left bank of the Congo, as lying at least half a degree more to the west, and in the same direction he transposes the positions of the mouth of the Itimbiri by $10'$, the widest and most northerly portion of the Congo by a full degree, and the mouth of the Aruwimi by half a degree. Again, whereas on Junker's map the Congo intersects 24° E. long. southwards of 1° N. lat., Habenicht puts the point of intersection exactly on that parallel. Junker's latest representation of the Welle, too, deviates not only from that depicted on the English and German maps, but also from it as traced on his own earlier maps, which are both more detailed and more exact. Whilst Junker nowhere makes this river cross the 4th parallel, Habenicht represents it as crossing three times. The former, again, puts every winding and every affluent of the Welle half a degree further to the west than they appear on Habenicht's map. The Werre is shown by Junker between 3° and 4° , and by Habenicht between 4° and 5° N. lat. We might perhaps at first sight be inclined to believe that Junker had consistently placed all his positions half a degree further towards the west, were it not that he represents the sources of the Werre as lying half a degree east of the situation assigned to them on Habenicht's map. Furthermore, the direction of the Werre on the two maps is not the same: Junker makes it south-west; Habenicht gives it as westerly, with the slightest possible inclination to the south-south-west. Finally, when we come to the Kuta-Mbomu, we find very serious divergences between Junker and the English and German cartographers. The intrepid traveller even calls in question the geographical determinations of Nachtigal and Lupton, which, although

made from different directions, yet corroborate one another with reference to the same region. The Kuta-Mbomu lies, according to Junker, between 4° and 5° N. lat., but according to Habenicht between 5° and 6° . From a letter written to the former authority we learn that Lupton's people covered the distance between Foro and the river Kuta-Mbomu in seven days, whence Junker estimates it at two and a half degrees of latitude; Habenicht, on the other hand, sets down the same route at eight days' journey, or only two degrees of latitude.

Schweinfurth's criticism upon Junker's map is to the effect that all distances are calculated at 3 per cent. more than they are on Ravenstein's, and that several positions are shifted to the west. It is, however, remarkable that the divergences between the maps of Ravenstein and Junker are greater in the case of the better-known places, and not so great for those with which we are less familiar. For instance, the route from Mesra by Gyur to Gattas measures 95 miles on the map of the German traveller, but only 79 miles on that of the English geographer. From this we are led to infer that Junker's data with respect to facts which we have insufficient means of controlling likewise deviate to a considerable extent. Assuming that Junker's data are perfectly correct, he would have penetrated to a relatively great distance into the *terra incognita* of Central Africa; nevertheless, in actual fact he went but a very little way west of the Itimbiri. We are therefore compelled to abstain from making use of Junker's results for the present. It is to be hoped that in his longer work describing his journeys (which he is now reported to be writing) he will have paid more regard to the existing literature bearing upon his subject, and to the cartography of the same. At all events, it is indubitable that the confluence of the Welle, Werre, and Kuta-Mbomu was never beheld by him.

As we have seen, none of the eight hypotheses mentioned is inextinguishable. We have, however, not yet mentioned the common basis upon which they all alike proceed, namely, that the Welle, Werre, and Kuta-Mbomu unite to form one and the same stream. Still we must not forget that this is only an hypothesis. In venturing to put forward a ninth view of the Welle problem, we offer it in complete independence of the hypothesis just alluded to. The solution of that problem involves not only the determination of the outlet of the Welle, but also of the sources whence the northern tributaries of the Congo between Stanley Falls and Equatorville get their great mass of water. For when we take this latter factor into consideration, we see that if all the streams of the Welle system pour their united volumes into the Congo, the remaining large affluents of this river will be deprived of their supplies. If, however, they do not all unite for this purpose, we obtain a result of an entirely different character.

We start with the hypothesis that the Welle, Werre, and Kuta-Mbomu do not unite their waters, for no confluence has ever yet been seen by a European. All that we know about the Welle is that it has first a westerly

and then a south-westerly direction. This however rests upon the information of natives, and is entitled to just about the same amount of credit as the statement made to Stanley by the natives of Nyangwe that the Congo flowed only northwards. From Junker's investigations we learn that the Welle proceeds towards the south-west; and the same remark holds good with respect to the Werre and the Kuta-Mbomu. Potagos, who did not see the Welle itself, but some other river which he took to be the Welle, has no information pertinent to the case in hand. And Lupton only speaks on the authority of native reports. From all this it results that of the confluence of the three rivers we possess no certain knowledge.

Thus there are between the Nile, the Shari, and the Congo four rivers whose direction, course, and embouchure are all unknown to us, viz., those of the Nepoko, Welle, Werre, and Kuta-Mbomu. We have also in the same region three rivers joining the Congo, about which we know nothing beyond their mouths. Besides these facts we have the large volume of the Shari still unaccounted for. Our theory then is this: we divide the four rivers first mentioned into two groups, the first embracing the Welle, Werre, and the Nepoko, which join the Congo, whilst in the second we place the Kuta-Mbomu, which we consider to belong to the Shari basin.

The grounds upon which we rest our theory are as follows:—

(1) The Aruwimi is the continuation of the Nepoko, as we learn from Stanley's latest reports: and since we are not acquainted with any important tributary of the Congo in the regions lying to the south of the Nepoko, this last river must receive several streams from that quarter.

(2) According to the data available for comparison, the volume of the Itimbiri agrees best with that of the Welle. The former river, below the Lubi Falls, varies from 750 to 870 yards in width, which corresponds to the volume of the Welle without the Werre and the Kuta-Mbomu. The Itimbiri also continues the direction of the Welle. It is not impossible that the Welle may pass through Lake Kei-el-Abi, and that this lake is, further, merely an expansion of the river. Besides, the distance between the nearest known points on the Itimbiri and the Welle is considerably shorter than that between the corresponding positions on the Werre or the Kuta-Mbomu and the Itimbiri. For these reasons we consider the Welle to be the upper part of the Itimbiri.

(3) Passing over the Werre in the meantime, we come to the Kuta-Mbomu. The term "Kuta" of the Mbomu is known to us from Lupton Bey's accounts. Now, Nachtigal's estimable servant reported a river of this name as being an affluent of the Shari. The basin of the Kuta-Mbomu is more extensive than that of any of the other three rivers; and the large volume of the Shari at its embouchure can only be accounted for on the supposition that it drains some basin of similar extent to this. Nor does the oscillation or rise and fall of the water at all invalidate this view, since that phenomenon has only been observed in the case of the Welle. The Kuta-Mbomu likewise lies much nearer to Nachtigal's Bahr-el-Kuta than the Aruwimi, Itimbiri, or Ubangi. We therefore regard it as pro-

bable that the Kuta-Mbomu belongs to the hydrographical system of the Shari.

(4) Turning now to the Werre, this river, in accordance with the conclusions we have come to above, can only belong to the Ubangi, and, as far as the direction goes, it may be looked upon as the upper course of the latter stream. It is true that the highest point yet reached up the Ubangi lies geographically nearer to the Kuta than to the Werre; yet that, we think, does not outweigh the reasons adduced above for counting the Kuta to the system of the Shari. On the other hand, there exists sufficient agreement between the volumes of the Werre and the Ubangi, as well as between the rise and fall of their flood-waters, to justify their identification.

The real solution of the Welle problem, however, to which we have ventured to add a new hypothesis, is one that can only be achieved at the expense of much money, and possibly human life. The expedition on which Stanley is at present engaged, although it has thrown some light on this hydrographical puzzle of the *terra incognita* of Central Africa, will hardly set all our speculations on the subject at rest, for the bold explorer is only skirting the confines of the unknown region, not crossing right through its midst.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

THE Anniversary Meeting of the Aberdeen Branch of the Society was held in the Albert Hall on the 8th November last—Mr. David Stewart, Convener of the Local Committee, presiding. The Earl of Aberdeen, Vice-President of the Society, delivered an address on "A Tour Round the World," and, on its conclusion, was awarded a most hearty vote of thanks on the motion of Lord Provost Henderson, seconded by Mr. Ferguson of Kinnmundy.

The Dundee Branch of the Society held its Anniversary Meeting on the evening of the 30th November last—Mr. A. J. Buist, presiding. Sir Charles Bernard, K.C.S.I., late Chief Commissioner of Burma, delivered an address on "Burma; the new British Province," which was illustrated by a series of lantern views. On the motion of Mr. Weinberg, seconded by Captain Clayhills Henderson, a vote of thanks was awarded to the lecturer.

An Ordinary Meeting of the Society was held in the Freemasons' Hall, Edinburgh, on Wednesday, 21st December last. Mr. Ralph Richardson, Honorary Secretary, presided. A paper by Sir Francis de Winton on "Explorations in Central Africa," was, in the unavoidable absence of the author, communicated to the meeting by Dr. George Smith, C.I.E. Dr. Robert W. Felkin, in response to an invitation from the chair, addressed the meeting at some length. A series of views illustrating the subject of the paper was subsequently exhibited by the lime-light lantern.

The Geographical Club held its first meeting on Saturday evening, 10th December last, when a discussion on the future of Tropical Africa was introduced in a paper by Mr. Joseph Thomson. The Club, it may be mentioned, has been established in connection with the Society, for the purpose of discussing geographical subjects, and is open to all members of the Society.