Government of Western Australia, by whom it has been well received, a project for penetrating from the West Coast by the valley of the Murchison River, due eastward, until he reaches the central line of telegraph which now connects Adelaide with Port Darwin. This will involve the exploration of about 1000 miles of “terra incognita,” and as it is thought probable that a large river, or rivers, may be found running eastward from the watershed of the Murchison, the Expedition may lead to results of vast importance to the colony. When we see, indeed, that a telegraphic wire, bringing us daily intelligence from Adelaide, is now laid continuously across the continent from south to north, along a line which was only first explored by Stuart in 1860, there would seem to be no reason for distrusting the power of the colonists to cross the continent in due time from west to east. At any rate, their enterprising spirit deserves our best encouragement, and we accordingly offer to Mr. Forrest our cordial wishes for his success.

I would further desire to draw the attention of the Society to the very important papers on forests as connected with Hydrology, by Dr. Brandis and Mons. Lemoine, as well as to two excellent Memoirs ‘On the Place of Geography in Education,’ and ‘On the Scope of Scientific Geography,’ by the Rev. Mr. Hale and Major-General Sirache, which were read before ‘Section E,’ at the late meeting of the British Association at Brighton, and the value of which was at the time pointed out by our accomplished Vice-President, Mr. F. Galton, who presided over the Section, and from whose able and enterprising papers on the cultivation of which this Society was instituted.

And now, Gentlemen, before concluding, I have only to announce to you that the Council, taking into account the special interest which at present attaches to the geography of the interior of Africa, in connection with Livingstone's explorations, have resolved to print an English translation of Dr. Lacerda's Travels from Tete to Cazembe, which has been lately placed at their disposal by our indefatigable correspondent, Captain Burton, and to circulate it, with the addition of a translation of the Fonbeiros' journey, and an abstract of that of Monteiro and Gamito, as a supplementary volume of the 'Journal.'

The Session may now be declared opened, and I hope it may be productive both of instruction and amusement to the Fellows. We are promised many papers of interest, one of the most important being a detailed account of the ascent of Kilimanjaro, by the Rev. Mr. New, of which an abstract, contained in a private letter, was communicated to you in the summer. Mr. New, I may add, who was temporarily connected with the Dawson expedition, and whom the Committee declared in their Report to have come out of the enquiry unscathed and without having in any way forfeited their confidence, is at present in England; but it is hoped that ere long his services may be utilized in renewed explorations in Eastern Africa, for which his knowledge, experience, and thorough acclimatization render him peculiarly fitted.

Mr. C. R. Markham, the Secretary, next proceeded to read the following paper:

Dr. Livingstone's Exploration of the Upper Congo. By Dr. E. Beuem.

Proofs of the Identity of the Luabala with the Congo.

The view expressed in the title of this paper, that the waters discovered and traced through a great extent of country by Dr. Livingstone during recent years, do not, as he believes, belong to the Nile, but to the Congo, is now almost universally held by the learned geographers; it appears frequently in the numerous writings and conversations upon Livingstone's and Stanley's reports. At the meeting of the British Association at Brighton, especially, its importance was sought to be maintained (in opposition to the subject unlearned in the geographical questions involved, and carried away by the presence of Mr. Stanley), and although adequate reasons were not brought forward for its support, yet the impression that gains ground as a necessary conclusion from the received facts.

Uncertainty was caused by the insufficiency of the arguments brought into the field; these were based on measurements of elevation, which, from the manner in which they were made, could only claim a small amount of exactitude, and upon the quantity of water in the rivers under consideration. Both of these arguments sufficed to separate the Luabala from the Nile, not, however, to carry it to the Congo. For this third element was necessary, which, being comprehended in the changes of the yearly seasons, is happily free from the errors of instruments and mistakes of travellers. As surely as the sun stands over the southern hemisphere in our winter, and over the northern in our summer, bringing the rains and the swellings of the tropical rivers when it is in the zenith in regard to them, so surely can it be predicted, from a comparison of the yearly seasons and times of rising, that the Luabala belongs to no river of the northern hemisphere; in the southern hemisphere Africa possesses only one river, the Congo, which could take up the vast water supply of the Luabala. It will now be endeavoured to establish the points thus indicated—

1. Elevations.—In his despatch of 1st November, 1871, to Earl Clarendon, Livingstone writes:—"Most of the intelligent natives and traders thought that all the rivers of the upper part of that valley (the Luabala Valley) flowed into Tanganyika. But the barometer told me that to do so the waters must flow up hill. The great rivers and the great lakes" (belonging to the

* Translated by Mr. Keith Johnston, from the 'Geogr. Mittheilungen.'
Lualaba "all make their waters converge into the deep trough of the valley, which is a full inch of the barometer lower than the Upper Tanganyika. . . 

. . . . . . The mean of many barometric and boiling-point observations made Upper Tanganyika 2880 feet high. Respect for Speke's memory made me hazard the conjecture that he found it to be nearly the same, but, from the habit of writing the Annals of Domini, a mere slip of the pen made him say 1844 feet; but I have more confidence in the barometers than in the boiling-points, and they make Tanganyika over 3000 feet, and the lower part of central Lualaba one inch lower, or about the altitude ascribed to Gondokoro.

The height of Gondokoro on the Kir or Bahr-el-Jebel, the main stream of the White Nile, coming from the Albert Lake, has been comparatively well ascertained by various measurements. According to Baker it is 1999 feet; Penney makes it 2060 feet; the height obtained by Doway (relatively to Kharum, 1345 feet from the mean of the best measurements) is 2068 feet; and Dr. Hann's investigations show that its elevation may be confidently taken at the average of 2024 English feet, and the surface of the Mwutau (Albert Lake) lies at 2720, or (according to Buchanan's re-computation of Baker's boiling-point thermometric observations) 2800 feet above the sea. Although we cannot yet set any great value upon the elevation determined by Dr. Livingstone, since the observations have not been subjected to any critical examination, yet the important difference of level between Tanganyika and the central Lualaba must be considered as established. The agreement of Livingstone's height for the Tanganyika with Findlay's correction of Speke's observation (2800) creates a decided confidence in his measurements. That the Lualaba cannot fall into the Tanganyika is then abundantly proved by these facts; Livingstone has also directly shown this to be the case by the route which he has traversed; his voyage especially round the northern half of the lake with Mr. Stanley, during November and December of 1871, shows that in this part of Tanganyika, where alone a connection with the Lualaba was conceivable, there is no great inflowing river. The largest, the Rusizi, coming from the northern mountains, was found to be not more than 30 yards wide and very shallow.*

The Mwutau (Albert Lake) is higher than the Lualaba may be accepted, if not with such certainty, at least with greater probability; for the lake must lie several hundred feet above the level of Gondokoro, which point is reached by its outflowing river after a course through several degrees of latitude, and down very considerable cataracts. Besides this, it is known from the observations of Baker and Speke, as well as through the reports received by Livingstone; that the high mountains of the Kafubu form a rampart on the west and south-west of the Mwutau, which must be cut through by the Lualaba if it should take its course to the lake, and through the lake to the Kir. The approach to all the western tributaries of the White Nile is also barred to the Lualaba by the Uelle, which Dr. Schweinfurth crossed in 1870 under 3° 37' N. lat. and 28° 10' E. of Greenwich, and showed to be a north-western flowing river, altogether south and outside of the basin of the Bahr-el-Ghazal.

The reports of Von Heuglin, Poncelet, and Schweinfurth agree in stating that the Uelle does not belong to the Nile system; Schweinfurth has made it at least very probable that the Suer, which he crossed in 5° 9' lat. and 28° 30' E., is the upper course of the Jur; the Uelle could therefore only be identical with the Bahr-el-Arab if it did flow to the Nile: but, beside the assurance of Dr. Schweinfurth that he has convinced himself of the opposite conclusion, there

is the strong fact that the Uelle, where Schweinfurth saw it in the middle of April, before the commencement of its rise, or at its lowest stage, carries a greater volume of water than the united streams of the Bahr-el-Ghazal, as will be seen by a comparison made further on. The point to which the Uelle flows, whether Schweinfurth's identification of it with the Shari is probable or not, is beside the question; this, however, may be noticed in passing, that, by reason of the time of its swelling, it can have no connection with the Congo, and that the somewhat earlier rise of the Shari is no ground for separating it from the Uelle, since the Shari may have other tributaries coming from further south.

Is it possible that the Uelle can be the continuation of the Lualaba? Dr. Schweinfurth's aneroid observations made during his Niam-Niam journey have unfortunately been for ever destroyed, along with his diaries, by fire, but his preliminary computation of these, made during the journey, gave for the Uelle an elevation of 2200, and later applied corrections 2300 English feet (relatively to Bahr-el-Arab, 2100 feet, feet). Even admitting a reasonable error of several hundred feet, this observation is fatal to any continuation of the Lualaba into the Uelle, because the lowest point visited by Livingstone on the former river was separated from Schweinfurth's crossing-point of the Uelle by seven and a half degrees of latitude. Moreover, in the neighbourhood of the place where Schweinfurth saw it, the Uelle is formed by two tributary or source branches, the Kibula and the Gadda, and the direction of both of these appeared to the traveller*1* decided to point for their origin, both to the Blue Mountains which Baker discovered in the north-west of the Albert Lake, and to those in the north of Tanganyika, which Speke recognised long ago as the most important water-parting of the continent.*

The existing measurements of elevation place no hindrance in the way of a union of the Lualaba with other rivers of Equatorial Africa,—the Shari, Bekama, Ogowai or Congo,—since the known portions of these rivers lies in the northern half of the lake, the absolute height of which was found, by Vogel to be 850, by Roblafs 1100 English feet. The height of the Benue in Akanuwa is given on Dr. Barth's map at about 800 English feet, but the aneroid observations made during Balzie's expedition, giving only 263 feet for Odjogo, show that the former estimate is too great. The Ogowai, at the confluence of its two main arms, is certainly not more than 300 feet above the sea, because one of its branches, the Nguni, was found by Du Chaillu above the Samba Falls to have an absolute height of 347 English feet.

Unfortunately there are no measurements of elevation for the Congo, but it can hardly have any great elevation above the point where it breaks through the chains of coast mountains. Tuckey's expedition believed that the highest mountains near the Congo were probably not over 2000 English feet high;† the most important cataract has a fall of only 30 feet on a stretch of 900 feet of the river course, and through the whole extent of the passage of the mountains the river remains for the most part navigable.

**2)** Volume of the Rivers.—If the hydrometrical data make a separation of the Lualaba and the Nile probable, this probability becomes a certainty on a comparison of the volume of water borne by the separate rivers. At the lowest

† Tuckey, 'Narrative of an Expedition to explore the River Zaire.' London, 1818, p. 351.
point of the Luалaba visited by Livingstone (the market of Nyangwe, in 4° s. lat., and between 25° and 27° e. Gr.), its stream in July, that is in the dry season—was at the rate of from 1 to 2 English miles an hour; the depth so great that men and women were drowned in it before the eyes of the traveller. The breadth of the river he gives at from 2000 to 6000 yards, or, in another letter, from 1 to 3 English miles; and to this he adds that the Luалaba could not be forded at any point, or at any season. Taking the minimum breadth of 2000 yards = 6000 English feet, the depth at 8 feet, and the current at 1 mile an hour (equal to 31 inches per second), the volume of water is 124,000 cubic feet in each second. Fortunately there exist measurements of the White Nile and its branches, taken during the season of lowest water, so that the figures are comparable with each other, and with those given for the Luалaba.

Peney found the Bah-r-el-Ebeel (the Kir, or river of Gondokoro) above Gondokoro, at the village of Tajbur, 45 metres broad, and, on average, 5½ metres deep, flowing at a mean rate of 85 metres in a minute. Baker estimated the breadth of the same river above the mouth of the Assu (3° 34' s. lat.) about 400 yards in March; at Jebel Kuku its width is increased by islands, rocks, and slime-banks, to one English mile; and, again, at one place, it is compressed to a breadth of only 120 yards. Sperke gives no figures, but he calls the Bah-r-el-Ebeel above the mouth of the Assu a "noble stream." Fetherick, on the 29th of April, or shortly before the rise of the rivers, measured the Bah-r-el-Ebeel above the mouth of the Bah-r-el-Ghazal, and the Bah-r-el-Abaib below the mouth of the latter; and from these measurements he was enabled to estimate the volume supplied by the Bah-r-el-Ghazal.*

Placing these measurements beside those of Schweinfurth, made in the middle of April on the Uelle, we have the following comparison:—

<table>
<thead>
<tr>
<th></th>
<th>Breadth in English Feet</th>
<th>Average Depth in English Feet</th>
<th>Current per Second in Inches</th>
<th>Cubic Feet of Water per Second in the Dry Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luалaba at Nyangwe—Livingstone</td>
<td>6000</td>
<td>8</td>
<td>31</td>
<td>124,000</td>
</tr>
<tr>
<td>Bah-r-el-Ebeel above Gondokoro—Peney</td>
<td>148</td>
<td>17</td>
<td>56</td>
<td>11,700</td>
</tr>
<tr>
<td>Bah-r-el-Ebeel above mouth of Ghazal—Fetherick</td>
<td>224</td>
<td>22</td>
<td>20</td>
<td>8,288</td>
</tr>
<tr>
<td>Bah-r-el-Abaib below mouth of Ghazal—Fetherick</td>
<td>481</td>
<td>14</td>
<td>20</td>
<td>11,339</td>
</tr>
<tr>
<td>Bah-r-el-Ghazal—Fetherick</td>
<td></td>
<td></td>
<td></td>
<td>3,042</td>
</tr>
<tr>
<td>Uelle in 3° 37' s. lat., and 28° 10' e. long.—Schweinfurth</td>
<td>325</td>
<td>12½</td>
<td>15</td>
<td>5,100</td>
</tr>
</tbody>
</table>

According to Schweinfurth's estimate, the channel of the Uelle at its very fullest, could only carry 17,850 cubic feet per second; and the vast superiority in volume of the Luалaba to the White Nile remains, even on comparison with the much higher results of the following measurements made, also in April, by de Malan:—


The Luалaba, then, bears at least nineteen times as much water as the Bah-r-el-Ghazal, with which Livingstone would identify it, and not less than three times as much as the White Nile.

From these figures it is sufficiently clear that it is impossible for the Luалaba to be a tributary of the Nile. The accounts of the volume of the Shari and Benue are less satisfactory, and do not admit of any such decided contrast with that of the Luалaba.

The smaller western arm of the Shari, the river of Logone, was found by Barth at Karmak Logone in March to be, for the most part, shallow, in some places 8½ feet deep, with a stream of about 3 English miles per hour; the breadth was from 550 to 600 paces. In the middle of August it became much larger, and, though not so broad as the Shari, yet it had a strong current of from 3 to 4 English miles an hour. The Shari itself, before its union with the river of Logone, was found to have a breadth of 2000 feet at Assu in March, and at Mele 1500 feet, with a channel 12 feet deep, and a very strong current. At the time of highest water the river sometimes overflowed its banks at the latter place, though these are more than 40 feet above its ordinary bed. Higher up, at Bugoman, the breadth was only from 1200 to 1500 feet, and the river had such a comparatively insignificant appearance that Barth at first took it to be a tributary: at this place also it appears to be, for the most part, shallow. In the middle of August the river at Assu showed a water-surface of at least 3000 feet broad; but this was broken up by numerous islands. The current was not greater than 3 English miles per hour, but the depth was so considerable that horses were forced to swim in crossing. In the month of September, when the waters are at their highest, the crossing is not attempted by the natives. The observations at Mele then give us the following data for the time of lowest water:

<table>
<thead>
<tr>
<th>Shari at Mele—Barth</th>
<th>Breadth in English Feet</th>
<th>Average Depth in English Feet</th>
<th>Current per Second in Inches</th>
<th>Cubic Feet of Water per Second</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1800</td>
<td>7½</td>
<td>60</td>
<td>67,500</td>
</tr>
</tbody>
</table>

Barth found that the Benue River, at the confluence of the Faro in Ada-
maus, was at least 1200 paces broad in the middle of June, and on an average 11 feet deep. The current proved itself so strong that Barth, in bathing, could not stand up against it (perhaps 3 miles an hour). The river had at that time fairly begun to rise; but, some months later, it was said to cover a point of land rising about 15 feet above its level, which separates it from the Faro. Judging from the evident marks on its banks, the Benue must often rise at least 50 feet. From these data a volume of about 193,000 cubic feet per second was calculated for the Benue, but, since the river was already consider-
The Upper Congo River.

On the other hand the known Congo corresponds perfectly to the volume which the Luvala must assume after its reception of the Quango and other tributaries. The Congo, as described in A. G. Findlay's Sailing Directions for the southern Atlantic Ocean (London 1856), "brings down an immense volume of water, which has hollowed for itself a narrow bed of very variable depth. In many places there is no bottom at 200 fathoms. Forty miles from its mouth its waters are only partially mingled with those of the sea, and sometimes nine miles out they are still quite fresh. . . . The main body of the stream of this mighty river is indicated by floating masses of bamboo, and debris of all kinds, which it carries far out to sea. The velocity of the current is said to range at from 4 to 8 miles an hour. . . . The stream of the River Congo is felt at a great distance out at sea, and ships which cross in going to the North or to the South, ought therefore to guard against it. It is stated that 300 miles out the water is discoloured, and that the current of the river is perceptible at that distance."

Tuckey who has followed the Congo further than any one, found it, above the cataracts which it forms in breaking through the coast range, to have a width of from 2 to 4 English miles with an unbroken surface, and a current of from 2 to 3 miles an hour; and the statement made in his travels (p. xiv.) that at the lowest stage of its water, it discharges two millions of cubic feet per second, is confirmed by the more recent survey by Vidal. According to this survey the river above Embombo (35 English miles from the mouth) has a regular channel, maintaining a uniform breadth for a long distance, only interrupted by a few very small islands.

Here, quite above the estuary, Tuckey found a current in the neighbourhood of the Diamond Rocks, of 34 English miles an hour, where Vidal's chart shows a width of 14 nautical miles (9000 English feet), and a depth in the middle of the stream of 50 fathoms (300 feet).

Taking as a minimum only 10 fathoms of depth for the average, though that depth is shown quite close to the bank, and instead of 34° only 2 nautical miles an hour for the current, we have for the

| Congo | 9000 | 60 | 40 | 1,800,000 |


The Congo is one of the great streams of the globe; it surpasses the Mississippi very considerably, since by the exact measurements and calculations of Humphreys and Abbot* the Mississippi at Carrollton in Louisiana, in its channel of an average breadth of 2470 English feet, has 975,000 cubic feet per second as its mean volume for the year. This amount increases in March to 1,150,000, but sinks at the lowest stage of the water in November to 228,000 cubic feet; whilst the difference between highest and lowest stage of the Congo is only from 9 to 9 feet, a proof that it is fed from great lakes. The Mississippi collects its water from a basin of 1,244,000 English square miles, but for the Congo there are at most only 500,000 square miles of drainage area available. If the basin of the Luvala, to which, according to Livingstone's and Magyer's reports, the Kassabi or Leke (the Leeki or Lomame of Livingstone) flows, extended 625. Africa West Coast, River Congo, corrected to 1867.


* English Admiralty Chart, No. 625. Africa West Coast, River Congo, corrected to 1867.

stone) is tributary, be deduced from this area, there would remain not more than 400,000 English square miles, an area which would not even suffice to form the Congo at its lowest state, since the rainfall of equatorial Africa (Manyumu land) from Livingston's observations during the rainy season of 1869-70, is not more than 58 inches; that is, not quite double as much as the average rainfall of the Mississippi region (30 inches).

Since then the Congo is the only river of Africa which in point of volume is capable of receiving the Luulaba, so, inversely, that inland river is necessary to account for the enormous volume of water which the Congo contains.

(3) Rainy seasons and the rise of the rivers.

The rainy season of a place within the tropics always begins when the sun has reached the zenith of that point. Then the trade winds, blowing regularly at other seasons, become gradually weaker, and at length cease and give way to variable winds and calms. The trade wind now no longer brings its regular supply of cooler, drier air; the rising heat and the calms favour an ascending current which bears the damp air into the upper regions of the atmosphere, there to be cooled down and to occasion the heavy downpours of the atmosphere. The nights and mornings are for the most part bright and clear. When the sun moves away from the zenith, the trade winds again begin to be felt and bring with them the dry season of the year, during which hardly ever a cloud disturbs the serenity of the skies.

Between the tropical lines and the equator, however, the sun comes twice to the zenith of each place. If now between the going and coming of the sun, from the equator to its furthest range, a sufficient pause intervenes, or if the sun's temporary distance from the zenith is great enough, the rainy season is divided into two portions, separated by a lesser dry season. Closer to the tropical lines, where the sun remains but once in the zenith, the rainy season is a continuous one. The order of the tropical rains is thus as follows:

1. The belt of calms, with rain during the whole year, strongest in March and September, extending from 4° S. to 3° S. of the equator.

2. The interrupted rains, with rain at each period when the sun passes the zenith, extending from 3° to 15° of lat. in each hemisphere.

3. The continuous rainy season, during the time that the sun is in the zenith, extending from 15° to 25° of latitude."

These conditions hold good as well on the sea as on land. The observations of travellers and resident missionaries in Africa, collected and arranged by A. Müllner, show the most satisfactory agreement with this theory. The belt of calms here occurs, generally speaking, the zone between 3° S. lat. and 5° S. lat., becoming somewhat wider on the east coast. North and south of this the rainy season corresponds to the arrival of the sun in the zenith; it happens thus during our summer in the northern hemisphere, and in our winter in the southern. The swelling of an African river is, however, dependent upon the rains, and thus from the observation of the time of the increase of an inedible conclusion may be drawn as to the climatic zone in which its sources or feeders lie. If a tropical river has its flood water in our summer, its sources cannot lie in the southern hemisphere, and inversely.

Applying this key to the present investigation, we can with the greatest certainty predicate that the Luulaba, which has its sources between 15° and 20° lat., will have its greatest volume in our summer, and will be at its lowest stage during our summer; for this truth, besides, we have Dr. Living-

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Dr. J. Haan, in 'Allgemeine Erdkunde, bearbeitet von Dr. J. Haan, Dr. F. von Hochstetter und Dr. A. Fukorny.' Prag, 1872.


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North:

<table>
<thead>
<tr>
<th>River</th>
<th>Begin to Rise</th>
<th>Highest Water</th>
<th>Decrease</th>
<th>Lowest Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahr-el-Ghazal</td>
<td>...</td>
<td>Aug. and Sept.</td>
<td>October</td>
<td>Mar. and Apr.</td>
</tr>
<tr>
<td>Uele</td>
<td>...</td>
<td>April</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Shari</td>
<td>...</td>
<td>September</td>
<td>...</td>
<td>Jan. and Feb.</td>
</tr>
<tr>
<td>Benue</td>
<td>...</td>
<td>May</td>
<td>Aug. and Sept.</td>
<td>October</td>
</tr>
</tbody>
</table>

South:

<table>
<thead>
<tr>
<th>River</th>
<th>Begin to Rise</th>
<th>Highest Water</th>
<th>Decrease</th>
<th>Lowest Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ogowai</td>
<td>Sept. and March</td>
<td>Oct. and April</td>
<td>Nov. and June</td>
<td>July</td>
</tr>
<tr>
<td>Luulaba</td>
<td>November</td>
<td>January</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

This collection of actual observations shows that the river of Gondokoro, like the Ghazal, the Uele, Shari, and Benue, have their highest water in our summer, and that therefore their feeders are mainly situated in the northern hemisphere, although the earlier risings of the Bahr-el-Jebel, and of the Shari, indicate that their basins extend into the belt of calms. The outfall of the Luulaba—which, on the other hand, has its high water in our winter—into any one of these rivers of the northern hemisphere is therefore impossible.

The Ogowai shows, by its plainly-marked double equinoctial times of high water, and by the season of its lowest state, that it has its tributaries in the belt of calms and in the region bordering on this to southward, not far from the equator. In this it offers a contrast to the Luulaba, not, indeed, so distinct as that of the Nile and Shari, but still very remarkable.

The Congo alone corresponds in the time of its rise with the Luulaba.

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(4) Concluding Remarks.—From the foregoing discussion it does not absolutely follow that the Luulaba is a branch of the Congo, because it might fall into an inland sea or lake without an outlet. Since the President of the Geographical Society of London expressed this conjecture, English geographers have shown that an inland lake can hardly be supposed to exist in the damp equatorial zone, for the reason that the enormous volume of the Luulaba, as well as of the other rivers which are tributary to it, would be a lake. Moreover, it would be essential that such a lake would have to be a vast inland sea, a second Caspian at the least; but a sea of this size, with its surrounding drainage basin, would take so much area that it would be disposed of (is not yet known) that no space in which the Congo could collect its giant waters would remain for it. It is also not possible that the smallest report of the existence of an inland sea without outlet; the assumption of such a feature seems quite superfluous, so much that all existing observations, as noted above, indicate a connection between the Congo and the Luulaba, and since the native reports confirm this in many ways.

Livingstone himself learned from a native who had accompanied the Portuguese expedition to the Kavembe, that it was believed in the Lwupula (the Luulaba before it passed Lake Moero) flows to Angola. Further, it was reported to him, that the great river Loei (in position and name probably identical with the Loke or Kassahi) flows through Lake Lincoln to the Luulaba; that the latter, passing thence by Nyanwe, where Livingstone saw it (in 4° 25' W. Greenwich), reached a great unvisited lake with many inhabited islands, emerging from that to form great marshy lagoons. Ladiamus Magyar,* who followed the Loke or Kassahi to a lower point than any other traveler, heard that this river takes an easterly direction in its lower course, and attains a breadth of several English miles; maintaining, however, the freshness of its waters, and becomes dangerous for navigation at some seasons of the year on account of its high waves. It is also reported to fall into a lake. Equatorial to that, is a lake known by the Nyassa, the only lake of East Africa known at that time by report, but his information agrees very closely with Livingstone’s reports, as well with his latest description of the Luulaba and Loei as with his former account of the connection existing between the Kasahi and the Congo.†

Magyar further states,‡ that “the Congo rises, as I have convinced myself by reports, in the interior of Africa, on the high plateau of Molowa, under 5° and 6° S. lat., and 25° to 26° E. long. Greenwich, in the country of Lulub, in a swamp named Inhan-ha. Uniting with the many streams of this region, at a distance of about five days’ journey (from the swamp), it becomes a deep though narrow river, which flows to westward, through a level country covered with dense forests, whose frequent streams coming from north and south are taken up by the river; then it bends north-westward, under the name Kwanza,” &c. Now we know, indeed, from Livingstone, that the sources of the Congo cannot lie in this position, and that these must be sought much farther toward south-east; but the swamp of Inhan-ha may be marshy lakes of Livingstone; and in any case Magyar’s reports trace the Congo to the region which is included in the Luulaba drainage.

Taking everything into consideration in the present state of our knowledge, there is the strongest probability that the Luulaba is the head stream of the Congo, and the absolute certainty that it has no connection with the Nile or any other river of the northern hemisphere.

Through this certainty, and by reason of the discovery that the Tangan-yika has nothing to do with the Nile system, the greatest problem of African hydrography, the question of the Nile sources, is in the main solved. That Livingstone has indirectly given the clue to this solution, must compensate the great traveller for having missed the actual Nile sources in exploring the Congo.

Speak’s views have been splendidly confirmed; the attacks of his opponents, specially of Burton, who was most inimically inclined toward him, collapse into nothing. Whether the Victoria Nyanza is one lake or several is a point of detail of less importance. The reports obtained by Livingstone, who can have no knowledge of what has been recently written on the subject, are, if anything, favorable to the unity of the Victoria Nyanza (Ukerewe, Ukara), because along with it he names only such lakes as were already known to have a surface no greater than that of Lake Tanganyika. The main point of interest, and the greatest gain from Livingstone’s new explorations, is that we now know that the White Nile springs in 3° N. lat., out of the Wuvua (Albert Nyanza), which receives its main tributary from the Victoria Lake (Lairm in this view in numerous bays). Its southern water-parting is formed by the Ulegga Mountains, rising to 9000’ or 10,000 feet in the west of the Wuvua, and stretching southwest as far as Manyessa Land (in about 3° S. lat.); 2ndly, by the mountains in the north of Tanganyika, which rise in Mount Mumburo, also to 10,000 feet; and 3rdly, by the plateau of Uwanwensi, so that no part of the Nile basin, extends beyond 3° S. lat. At the western and south-western bays of the Ulegga Mountains, as well as to westward of the high land in which the Tanganyika is sunk, there begins a lower-lying plateau, rich in forests and streams, with a numerous population belonging in race to South Africa, separate and distinct from the inhabitants of the Nile valley and the east coast; with flora and fauna, which by characteristic types—the oil palm and the gorilla for example—alike themselves with those of the west coast.

Schweinfurth, as well as Livingstone, has crossed into this western interior region, and has been the first to see the source of the Great River, passing over the watershed of the Bara and Obangi to the basin of the Uele; but the closer examination of this newly-opened region of Africa may be left for another paper, in which its features will be treated of in connection with Dr. Livingstone’s latest journey.

The most important goal of African research is now undoubtedly the Congo; it appears in very truth to be the “Moisini Enzaddi,” as the natives named it, to Captain Tuckey, “The Great River,” the river which swallows up all the others. The supposition that he might alter all be on the Upper Congo seems to have often arisen in Livingstone’s mind; and he says bitterly, “Who would care to run the risk of being put into a cannibal pit, and be converted into blackman for anything less than the grand old Nile.” Now, however, that through Livingstone and Stanley the last doubts of the accuracy of Speak’s views are set at rest, the Congo remains the most worthy, the most promising, object of African exploration.

Mr. F. Galton said that all who had taken an interest in the progress of African discovery must feel delighted that the Congo was at length to be explored. The paper that had just been read seemed to be convincing in most particulars, but somehow it missed an important point. He did not think it proved its case. It stated that the rise of the waters of the Congo must be due to the rise of the Luulaba, because the rises were nearly simultaneous. The fact, however, was that the Congo rose before the Luulaba, namely in September, while the latter rose more than a month later, namely in November, and it would require an additional fortnight or three weeks for the rise in the latter river to be felt 600 or 600 miles off in the Congo. Another particular of the Congo was that it commenced to rise before the rains reached its mouth, although that part of it is more to the north than
are the known parts of the Luvalua. Captain Tuckey found that it rose in September when the sky was only slightly overcast, and the actual rains did not begin till a fortnight or three weeks later. This fact seemed indispensably to point out that the water in the river came in some degree from the country to the north of its mouth, and was easily accounted for by supposing that the Luvalua took a sweep northward before it became the Congo. The later rise of the Luvalua would then cause the continuance of the rise of the Congo, whose long period of high water was one of its peculiarities. The connection with the Luvalua could not account for its early rise unless there was no northerly wind.

Mr. Fidley said, according to all accounts, Tanganyika was a freshwater lake and must have an outlet, although none had as yet been discovered. It was a singular coincidence that he should in 1867 have made it exactly the same elevation as Livingstone, and also the same as that of Albert Nyanza, but the elevation of Sir S. Baker’s Lake was not as yet quite decided. He had thought that a small error in the observations might have slightly still raised the Tanganyika, and thus raised the Luvalua and the unvisited lake, and that a correction of that error might make the two lakes to coincide; but, after due consideration, he had given up that opinion on account of the dates of the rising of the waters and the comparison of the volumes. The rising of Tanganyika was identical with that of Albert Nyanza, and, therefore, although the northern end was closed, he did not think the question of the disposal of the waters of Tanganyika was yet settled. No doubt the southern end, too, had been closed by Livingstone’s explorations. Nothing was known of an eastern outlet, and it would be very singular if there were one, because it would be in opposition to the course of the Malagash. Mr. Stanley stated that he heard the sound of a large cataract (or surf) on the western side, which could not be far from Ujiji. It might be that there was an outlet on that side to Baker’s Lake. It was to be hoped, however, that the whole question would be soon settled by exploration, and thus render speculations unnecessary.

Mr. Galbraith said he regarded the separation of Livingstone’s discoveries from the source of the Nile as a great triumph for his late companion Captain Speke. Some four or five years ago, Livingstone wrote home to say that he had come upon the source of the Nile in 10°11’ S. latitude. He (Colonel Grant) had, however, felt convinced that these sources of Dr. Livingstone had not what ever to do with the Nile, and the description which had lately reached England confirmed him in this opinion; namely, Livingstone mentioned having seen the skulls of gorillas, that the women of Manyuema, or near there, dive in the water and bring up cysters, etcetera; but throughout Captain Speke’s journey, the gorilla was never once met with, though heard of to the west of it; such a custom as the women of the Nile region diving was never seen nor heard of, and cysters in the centre of Africa are of course an impossibility, although large bivalve shells of a new species were brought home from Tanganyika by Speke. Another remarkable custom is related in Dr. Livingstone’s letters, that the inhabitants about Manyuema domesticate pigs: this at once indicates a strange race; for though the people of Nile-land hunt and eat the wild bear, they do not keep it in a tame state, and the Mahomedan races far down the Nile are forbidden by their religion to defile themselves with this animal. If a reference be made to Captain Tuckey’s Travels on the Congo, these customs of women diving and the domesticating of pigs will be found recorded. From these facts he (Colonel Grant) had formed his opinion that Speke’s Nile was distinct from Dr. Livingstone’s discoveries, and, since hearing the paper of to-night giving the comparison of the Luvalua and Nile volumes of water, this opinion received additional confirmation. He protested against the new form of three lakes given to the Victoria Nyanza