

ported by those of three other observers, two of them being the Government geologists, render more singular the statements of Messrs. Officer and Spencer (NATURE, June 29, p. 198) as to their not finding any traces of glaciation in the country around Lake St. Clair, which they explored for a month. Lake Dixon, which Mr. Johnston describes as presenting all the evidences of glaciation in their fullest development, appears to be less than ten miles from the lower end of Lake St. Clair, according to the best map I can refer to; while Lake Petrarch, which Mr. Officer describes as seeing from the top of Mount Olympus, lies between the two in the Cuvier valley, and is also mentioned by Mr. Johnston as being within the highly-glaciated region. It is quite possible that the lakes on the great plateau may be due to damming up, owing to movements of the superficial gravels and clays by the ice or *névé* sheet; but there are evidently an abundance of small valley-lakes and tarns in the western valleys so surrounded by all the marks of extensive glaciation as to render it almost certain that they are true ice-eroded rock basins. It is much to be wished that a more detailed account of this interesting district, with a good map showing all the mountains, lakes, and valleys referred to, would be given us by one of the local geologists.

ALFRED R. WALLACE.

The Supposed Glaciation of Brazil.

MR. WALLACE observes in his letter on this subject, published in NATURE (vol. xlvi. p. 589), that "no authoritative disproof has yet been given of the exceedingly strong and positive statement of Agassiz and Hart."

I confess to my mind the matter had seemed disposed of by the interesting discussion of the subject to be found in the "Notes of a Naturalist in South America" (1887), by the late Mr. John Ball, F.R.S. This experienced and accurate observer arrived at the conclusion from a study of the phenomena on the spot, that they could be sufficiently accounted for by subærial denudation (see, in particular, pp. 313-8).

In the following passage he rejects the agency of glacial action as definitely as his habitual caution and modesty would allow:—

"I was unfortunately not acquainted at that time with the observations made near Tijuca by Prof. Alexander Agassiz, which appear to him to give evidence of glacial action in this part of Brazil. It would be rash, especially for one who has not been able to examine the deposits referred to, to controvert conclusions resting on such high authority; but I may remark that the evidence is confessedly very imperfect, and that the characteristic striations, either on the live rock or on the transported blocks, which are commonly seen in the theatre of glacial action, have not been observed. I lean to the opinion that the deposits seen near Tijuca are of the same character as those described by M. Liais as frequent in Brazil. The crystalline rocks are of very unequal hardness, and while some portions are rapidly disintegrated, the harder part resist. The disintegrated matter is washed away, and the result is to leave a pile of blocks of unequal dimensions lying in a confused mass." (P. 342.)

W. T. THISELTON-DYER.

Royal Gardens, Kew, October 23.

The Nativity of Rama.

I HAVE been much interested in the letter of "Kanhaiyalal," which appears in your issue of August 31. I fully agree with him in the view taken in regard to the verification of dates by astronomical methods, and it really does seem somewhat singular that the example of Sir William Jones, the pioneer of Orientalism in Europe, should have been entirely neglected by his learned colleagues and successors in this department of research. From many considerations it must be obvious that wherever mention of planetary "yogams" or conjunctions, sidereal and lunar positions, &c., are given in the text of any classical work, they are to be preferred to any arguments drawn merely from literary style and other empirical data—so much relied upon by Orientalists and scholars generally—when the question is one of a calendaric date.

I have endeavoured to work out the calculation of Rama's birth figure. In *Ramayana* is the following slokam, or stanza, referring to Rama's birth:—"Chaitre navamike tilhau Nakshatre aditi daivatye sewochha samstheshu panchasu

¹ See his valuable work, "Climats, Géologie, Faune et Géographie Botanique de Brésil."

Griheshu karkate lagne." From this we learn that Rama was born in the ninth day of the Moon's age, and that five planets were in their exaltation signs, the rising sign (*lagnam*) being Cancer (of the Hindu Zodiac). The planets' places are given in Section 18 of the English translation of *Ramayana*, by Manmatha Nath Dutt, M.A., in the following words:—

"And then, when six seasons had rolled away after the completion of the Sacrifice, in the twelfth month, on the ninth lunar day, under the influence of the Punarvasu asterism, when the Sun, Moon, Saturn, Jupiter, and Venus were at Aries, Capricorn,¹ Libra, Cancer, and Pisces, and when Jupiter had arisen with the Moon at Cancer, Kaushalya gave birth to that lord of the universe, bowed unto by all the worlds, Rama, &c."

It may be well to state for the benefit of those not acquainted with the Hindu zodiac, that an asterism includes 13° 20' of the ecliptic circle, and consequently there are twenty-seven asterisms in all. Of these, Punarvasu is the seventh. The zodiac commences with the asterism *Aswini*, and the fixed star *Revati* is the point from which enumeration of longitude begins. This star is said to have been coincident with the equinoctial point *To* in the year 3600 of the Kali Yuga, i.e. 498 A.D.

The last conjunction of Saturn and Jupiter in the sign Libra was in K.Y. 4224, and the one previous in K.Y. 1344; and from this we must subtract three Signs to bring Jupiter into Cancer (its exaltation). This equation referred to the "period" of Jupiter, i.e. twelve years, gives three years to be subtracted. The year K.Y. 1341, therefore, would see Saturn in Libra, and Jupiter in Cancer as required.

The Moon being nine days old at the birth of Rama, and its motion in respect to the Sun being 12° per day, its distance from the place of conjunction must be taken as over 96°. But it is stated in the *Slokam* that the Moon is in Punarvasu, and as this asterism ends at 93° 20' from the star *Revati*, it is evident that the conjunction of the luminaries took place in the twenty-sixth degree of *Minam* or Pisces; and that on the ninth day the Moon was in the first degrees of Cancer (Hindu *Kartaka*) and the Sun in the fifth degree of Aries (Hindu *Mesham*).

To determine the date of this planetary epoch we must have recourse to the *Ayauamsha*, the distance between the fixed star *Revati* and the Vernal Equinox. The Hindus compute this to be 54° per year, and in accordance therewith their month of *Mesham* (Aries) begins on April 11. At the present time *Revati* is behind the Equinox, but in K.Y. 1341 it was in front of it, regarded by the order of the Signs. The calculation for K.Y. 1341, according to *Suryasiddhanta*, is:—

$$(3600 - 1341) \times 54'' = 33^\circ 53' 6''.$$

Referring this to the Equinox, it gives a point corresponding to the twenty-seventh degree of Aquarius in our zodiac, which was the point at which the Hindu zodiac began in the year K.Y. 1341; and from this we must take 4° to bring us to the 26th of *Minam*, wherein the Sun and Moon were conjoined at the birth of Rama. The result is the twenty-third degree of Aquarius in our zodiac.

We have already obtained the year K.Y. 1341 from the positions of the planets Jupiter and Saturn, and we may now apply this luni-solar position as a test.

On February 11, 1888, the Sun and Moon were conjoined in the twenty-third degree of Aquarius. This date corresponds to the beginning of the tenth month of the K.Y. year 4989. Applying the Metonic cycle, we find that a conjunction of the luminaries also took place in the twenty-third degree of Aquarius (Hindu twenty-sixth *Minam*) in K.Y. 1341, thus:—

$(4989 - 1341) \div 19 = 192$ exactly. I have not yet made reference to the position of Venus as given in the above *Slokam*, but I think there is strong evidence of this being the correct epoch, and I think it not unlikely that Venus had less than 30° west longitude of the Sun, in which case it would be in the Hindu sign corresponding to our Pisces, i.e. *Minam*, as required by the *Slokam*.

This epoch corresponds to noon (local time) February 10, 1761 B.C., disregarding the change of Style; and, if correct, may be the time of the birth of Rama; but on this point I should not care to judge too hastily, for in view of the recurrence of these positions at some earlier or later date, we have no evidence which should lead us to select one rather than another epoch.

One thing strikes me as sufficiently curious to record in

¹ This should be *Cancer*, not *Capricorn*, as is seen from the fact of the Moon's rising with Jupiter.