Marco Polo's "exceeding great wild sheep, having horns, some of them six spans long," the "forms" of which, Alcock tells us, are to be found especially on the bare, unstable screes to the north of a Pamir. The economic botanist knows that *Ovis poli* is not the only creature which finds this herbage wholesome. Marco Polo had been told that in this region "are excellent pastures, so that in them a lean horse or an ox may be fat in ten days." Five hundred years later the same opinion was expressed in very nearly the same words, for Lieut. J. Wood, who journeyed to the sources of the Oxus eighty years ago, was assured by the Kirghiz that "the grass of the Pamir is so rich that a sorry horse is here brought into good condition in less than twenty days." The experience of the Pamir Boundary Commission of 1895 did not belie these older estimates, for Alcock informs us that, "of the many pack-animals met with on our return march from Gilgit to Kashmir, none approached our baggage-ponies in condition."

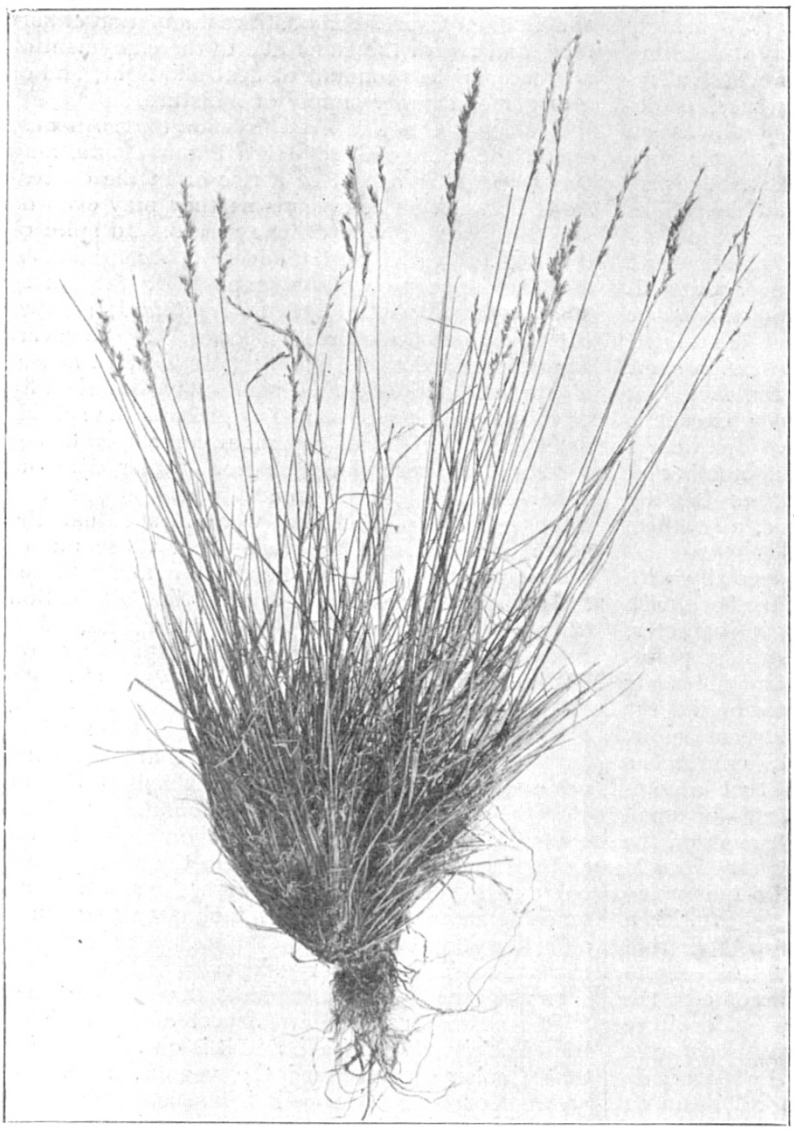

FIG. 2.—*Poa attenuata*, Trin. (about half natural size). From 'Studies in the Vegetation of Pamir."

Pamir air may perhaps assist the Pamir grass, for the climate of these lofty uplands is as healthy as it is severe. Paulsen describes in poetic terms the sense of well-being experienced by the Danish explorers during their halt near Lake Jashil-kul in August, 1898. Their days, it is fair to admit, were days of gentle breeze or calm. If such halcyon seasons be a feature of the valley sheltered by the Shatyr-tash, that Pamir is favoured beyond those that lie between the Ak-baital pass and the Alai range, or those between the Chargush pass and the Hindu-Kush.

However this may be, Prof. Paulsen, in these "Studies," has provided an account of the High Pamir and its vegetation so clear and so fascinating that his readers must feel prepared to face the bitter winds experienced by Alcock in the Aksu Pamir in 1895, and by Fedtschenko in the Karakul Pamir in 1904, should fate afford any of them an opportunity of visiting the region and subjecting the eastern valleys to the careful study bestowed by him and his companions on so many of the western ones.

Primitive Chronology.

By DR. J. L. E. DREYER.

THE study of the ideas of uncivilised races with regard to chronology has generally been left to travellers who derived their information from natives among whom they dwelt for only a short time. The progress of civilisation among such races has often made it difficult to obtain trustworthy information about the way in which the division of time was formerly regulated among them. When attempts have been made to collate the information to be found in books of travel and in works on ethnography, as has been done in the ninth chapter of Ginzel's "Handbook of Chronology" (vol. ii.), the result has been a collection of scraps rather than a systematically

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arranged account of the first steps made by mankind towards a knowledge of the division of time. The detailed work on this subject by Prof. Nilsson,[1] of Lund, is, therefore, a most welcome addition to the literature of chronology, and, being based on a thorough study of the immense number of publications on the ways of primitive nations, it is fit to form an introduction to the great work of Ginzel, which chiefly deals with the chronological systems of more advanced races.

To the lowest tribes of mankind the seasons are the earliest units of time. Except in the tropics, hot and cold seasons succeed each other, and where the year is not spoken of, the number of summers or winters which have elapsed since a certain event took place is the earliest way of describing intervals of time. This practice is often continued in more civilised times—*e.g.* in the Middle Ages among Scandinavians and Anglo-Saxons time was reckoned in winters. In some localities the atmospheric conditions are such that two divisions of the year may be distinguished by the winds, as in the Marshall Islands, where months of calm and months of squalls succeed each other. In other places there are regularly recurring dry and wet seasons. People who engage in agriculture often divide the year into a greater number of seasons, eight or nine, according to their occupations, and even in China there is found, alongside the luni-solar year and its subdivisions, another system of dividing the year into twenty-four parts, the names of which refer partly to the weather, partly to other phenomena. In northern India there were originally (as there still are in Burma) three seasons, a hot, a rainy, and a cold, among which two or three transitional ones were later interpolated. Similarly, the Indo-European nations had three seasons—winter, spring, and summer—which were later subdivided into shorter seasons of ploughing-time, hay-making-time, etc.

Though we have spoken of the year being subdivided into various parts, this must not be understood as meaning that the use of the solar year is as old as the time-indications referring to natural phenomena. Not seldom the dry and rainy or warm and cold seasons are counted without being combined into a year. In Iceland there still exists a curious calendar, which divides the year into two parts—*misseri*—and the people count so many *misseri*, not years. Until midsummer (or midwinter) they reckon forwards, and say that so many weeks of summer (or winter) have passed; after that they say that so many weeks remain. The climatic year is a cycle which has no regular beginning, but the agricultural year has a natural beginning, which is generally marked by the rising of a certain star or group of stars, often the Pleiades, before sunrise (the heliacal rising).

The word for "year" is usually one referring to produce, but among the lowest races only a few years are counted, perhaps three or four; everything further back is merely said to have happened "some time ago." This is often sufficient, as such savages are frequently not interested in their own age or in that of other people, but only in that of their cattle. As to epochs from which the years may be counted, it is not until the beginning of history that the accession of kings is used for this purpose. Before that time some unusual event marks an epoch, such as a very severe winter or a great war, and as culture progresses such events multiply; and when their succession is known, a longer period is the result. This method of distinguishing the years was employed in ancient Babylonia, in the days of the Sumerian kingdom of Ur, in the second half of the third millennium B.C. The king's accession marks only one year, the others being named by events in the religious cult and politics. Similarly, in the older period of Egyptian history each year is described by an official name borrowed from the festivals—*e.g.* those of the king's accession, of the worship of Horus, of the sowing, etc.

The natural subdivision of the year is formed by the period of revolution of the moon with regard to the sun, or, what comes to the same thing, the period of its changing appearance, its phases. Man's attention must have been directed to the moon from the very infancy of time, as the course of the moon from the first appearance of the new to the disappearance of the old is short enough to be surveyed by the undeveloped intellect. Almost everywhere the "month" as a unit of measure is denoted by the same word as the moon. At first no attention was paid to the number of days in the month, and many primitive peoples cannot even count as far as thirty. But the changing form of the moon is sufficient as an indicator of time, and greater refinement of observation is by degrees attained until every day of the moon's revolution is described by a name. Such names often not only refer to the phases of the moon, but also indicate its position in the sky. The first appearance of the lunar crescent is an important event carefully watched for and often celebrated as a feast day. The full moon also gives rise to special feasts; half Africa dances in the light of the full moon. So did the ancient Iberians and many others.

The next step in the progress of primitive chronology is to group a number of months together into a cycle. At first, uncivilised peoples with an undeveloped faculty of counting can numerically determine only a couple of months before or after the time of the moon at the moment visible in the heavens. The months are then given names from the principal agricultural operations going on when the moon appears and while it lasts, and this often leads to the same moon having several names. If all the names in use among Melanesians were counted, the year of the natives would seem to be made up of twenty or thirty months. At this stage the question how

[1] "Primitive Time-reckoning: A Study in the Origins and First Development of the Art of Counting Time among the Primitive and Early Culture Peoples." By Prof. Martin P. Nilsson. (Skrifter Utgivna av Humanistiska Vetenskapssamfundet i Lund, I.) Pp. xiii+384. (Lund: C. W. K. Gleerup; London: Humphrey Milford; Oxford University Press 1920.) 21s. net.

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many months there are in the year does not exist, and in some cases the reckoning by moons is not even extended to the whole year. There is a time when nothing particular happens and nobody takes the trouble to observe or name the moons; such a period is, for instance, the depth of winter in the far north. It is next realised that the succession of seasons is intimately connected with the motion of the sun. In northern countries it is noticed by people having a fixed dwelling-place that as midsummer is drawing near the sun is rising further and further north until a limit is reached. In this way the date of the summer solstice; and similarly that of the winter solstice, are determined, and a rough idea of the length of the year is obtained, and is improved by observing the heliacal risings of certain stars. It is thus found that the year is longer than twelve moons, and shorter than thirteen, and the next problem is how to make the lunar months fit into the solar year by the occasional interpolation or omission of a month. This is the beginning of scientific chronology as we see it arise and developed among the Babylonians and the Greeks.

Prof. Nilsson's valuable work was written by him in Swedish, and translated into English by a colleague in the University of Lund. The translator has followed the original closely, sometimes too closely, and he uses some curious expressions, such as "the phases of the stars," or the "shifting year" of the Egyptians (meaning their vague year). But these are trifling faults in an otherwise excellent book.

Obituary.

PROF. A. W. REINOLD, F.R.S.

ARNOLD WILLIAM REINOLD, who died on April 11, was born at Hull on June 19, 1843, and was the son of John Henry Arnold Reinold, a shipbroker at that place. He was educated at St. Peter's School, York, and matriculated at Brasenose College, Oxford, in 1863, as an open Somerset scholar. He had a distinguished career as a mathematician, obtaining the University junior and senior mathematical scholarships, first classes in mathematics, moderations, and finals, and in the School of Natural Science. In 1866 he was elected to a fellowship at Merton, and in 1869 became Lee's reader in physics and a senior student at Christ Church. He was the late Prof. Clifton's first demonstrator in the Clarendon Laboratory, being succeeded by A. W. Rücker.

In 1873 Reinold was appointed professor of physics at the Royal Naval College, Greenwich. His life-work was done here, as he held the post for thirty-five years, retiring in 1908 on reaching the age limit, and being made a C.B. in 1911. This professorship was a new appointment, so that a laboratory and courses of physics had to be organised; the laboratory buildings were part of the sick quarters of the old hospital, and finally occupied a considerable amount of space. Besides our own naval officers, gunnery and torpedo lieutenants, naval architects and engineers, etc., there were occasionally foreign students working here, and Reinold received a medal from the Emperor of China in recognition of work with Chinese students. It was at Greenwich that he collaborated with Rücker in a series of investigations on the properties of liquid films, the first paper appearing in the Proc. Roy. Soc. for 1877, and the final one in the Phil. Trans. for 1893, with several between. He was a lecturer at Guy's Hospital for most of his time at Greenwich, and a joint editor for several editions of Ganot's "Physics."

Reinold was signally devoid of any hobbies, and seemed to have no recreations. His interests apart from his work were mainly in the Physical Society, of which he was an original member, if not one of the founders, acting as secretary from the beginning until 1888, when he became president for two years; and in the Royal Society, of which he became a fellow in 1883, and on the council of which he served for some years. He was a sensitive man with a charming manner, and was liked by all who came in contact with him, being always courteous and gentlemanly in the fullest sense. Reinold retained his activities, mental and otherwise, to the end, which occurred very suddenly; he had just undertaken to write an obituary notice for the Royal Society of his old chief, Prof. Clifton. Married about 1866 to Miss Marian Studdy Owen, he leaves a family of one daughter and three sons. W. N. S.

ROBERT ALLEN ROLFE.

SYSTEMATIC botanists, and especially orchidologists, have sustained a grievous loss by the death on April 13, after rather more than three months' illness, of Mr. R. A. Rolfe, who, for upwards of forty years, was an assistant in the Herbarium of the Royal Botanic Gardens, Kew. Mr. Rolfe was born at Ruddington, near Nottingham, on May 12, 1855. He joined the Kew Herbarium staff in 1880, as a result of a public competitive examination, having previously gained some experience among cultivated plants in the famous gardens at Welbeck Abbey, Notts, and at Kew. It was anticipated that he would retire from service next month, and a visit to Central America was projected, for which a grant in aid had actually been voted by the Government Grant Board of the Royal Society.

Mr. Rolfe's contributions to botanical literature have been numerous and important. For many years past he was the generally accepted authority in this country on the Orchidaceæ; it might truthfully be said that his reputation was world-wide. He founded the *Orchid Review* in 1893, and edited and wrote to a large extent the twenty-eight

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