

IMITATION CHEESE

IN NATURE, vol. xxv. p. 269, we gave an account of the mode of manufacture of "butterine," a compound containing about 90 per cent. of a mixture of animal fats known as "oleomargarine."

"Butterine," as the name would imply, is an imitation butter which is largely imported into this country from America and from Holland. "Oleomargarine" is principally made in the United States by the patented process of Mège-Mouries, which consists in heating disintegrated suet to a temperature of 120° F., when a clear yellow oil is (to borrow a term of the metallurgists) "liquated out." This is allowed to solidify, and "refined" by subjecting it to pressure at a temperature of about 90° F. "Oleomargarine" is converted into "butterine" by adding about 10 per cent. of milk to it and churning the mixture, colouring the product with annatto, and rolling it in ice to "set" it. Some idea of the development of this industry may be gleaned from the fact that Mr. Nimmo, the chief of the United States Statistical Department, reported that the export of oleomargarine for the year ending June 30, 1880, was close upon 19,000,000 pounds. And this is probably under-estimated, as it is certain that considerable quantities of "butterine" passed through the Customs under the designation of butter. It is not very easy to get data which are altogether trustworthy; but looking to the rate of increase furnished by the statistics of previous years, it is probable that the present export of oleomargarine from America is not less than from 25,000,000 to 30,000,000 lbs. per annum. Oleomargarine was the subject of some discussion in the House of Commons during the last session, and the matter was again brought up a few nights ago in the form of some interrogatories addressed to the President of the Board of Trade.

It appears that oleomargarine has recently taken a new departure, and that its use is no longer confined to the manufacture of "butter substitute," or "butterine." Our ingenious friends on the other side of the Atlantic have discovered that a mixture of oleomargarine and blue skim milk make what Mr. H. M. Jenkins, the Secretary of the Royal Agricultural Society of England describes as an excellent imitation of "American Cheddar." Indeed, so excellent is the imitation, that competent judges in the City and elsewhere informed Mr. Jenkins that unless they had been told, they could not have distinguished the oleomargarine cheese from ordinary American cheese, and that they valued it from 52s. to 56s. per cwt. wholesale, and from 8d. to 9d. per lb. retail. American cheese of presumably legitimate origin is of course a well-established article of importation into this country; the estimated value of the cheese we import is upwards of 5,000,000l., of which at least one-half is credited to the United States; and "American Cheddar," "American Cheshire," "American Stilton," &c., are well-recognised terms among retail provision dealers. We are now to have "Imitation American Cheddar," "Imitation American Stilton"—Stilton and Cheddar, in fact, several times removed; and Mr. Jenkins tells us that a very extensive trade will be shortly established in these articles, provided that their quality proves to be sufficiently good for the English market. Samples of these

imitation cheeses have been examined by Dr. Voelcker, the chemist to the Royal Agricultural Society, who pronounces them to be perfectly wholesome articles of food. If the "oleomargarine" which enters into their composition be obtained from healthy fat or suet, there is, of course, no reason to doubt their wholesomeness or their alimentary value. Provided that the proportion of skim milk and oleomargarine be properly adjusted, the composition of the imitation cheese will differ but slightly from that of the best English made cheese, and will, so far as its nutritive value goes, be probably preferable to the ordinary skim milk cheeses of this country, or even to the more esteemed varieties of Gruyère and Parmesan. "Imitation factory cheese," as Americans call the new produce, will, of course, be almost entirely wanting in the characteristic fats of milk, such as butyric, capric, and caproic, to the decomposition of which the ripening and flavour of good cheese is mainly due. As is well known, hard solid cheese, in which the proportion of fat is comparatively low, ripens but slowly, and unless artificially flavoured, as in the case of Parmesan, acquires little or no piquancy. On the other hand, a rich cheese rapidly loses the acid reaction which it has when new; the casein and the fat suffer change, and the fatty acids thus formed combine with the products of the decomposition of the nitrogenous constituents giving rise to compounds, which, when accompanied by a due proportion of the green mould of *Aspergillus glaucus*, or the red mould of *Sporendonema casei*, afford the piquant flavour and aroma of the more valuable varieties of cheese. Such cheeses, however, soon run into putrefactive decay; they become strongly alkaline, and may even give rise to poisonous products. The fats of "oleomargarine" consist mainly of olein, stearine and their congeners, and are much more stable compounds; hence the cheese in which these bodies function will ripen comparatively slowly, and would of themselves never acquire the flavour of such rich cheeses as Stilton or Double Gloucester. Still art can do much, and he would be rash who would attempt to set a limit to American ingenuity; but we may at least hope that *Aspergillus* and *Sporendonema* may prove to be beyond the reach of the imitative power of the Transatlantic cheese-merchant.

T. E. THORPE

THE IRRAWADDI RIVER

Report on the Irrawaddi River. Part I. Hydrography of the Irrawaddi River. Part II. Hydrology of the Irrawaddi River. Part III. Hydraulics of the Irrawaddi. Part IV. Hydraulic Works connected with the Nawoon River. Parts I. and II. (in one vol.), 195 pp.; Part III., 227 pp.; Part IV., 151 pp. fol. By R. Gordon, Esq., M.I.C.E., &c. (Rangoon, 1879-80.)

THIS is a valuable Monograph on the Irrawaddi River by the Executive Engineer of the great Embankment Works of the Irrawaddi Delta, the well-known experimenter and writer on river hydraulics. The mode of publication does not do justice to the great labour and research shown in so large a work (573 pp. folio). It is apparently a Government Report, written in the period 1877-80, and printed at the Government Secretariat Press, Rangoon, in 1879-80. Great allowances must always be made for the difficulties in proper correction of the proofs

of a work published at a small native press at a great distance from the author. Still the misprints in this work are quite unusually numerous, sometimes *three* in a single line of French or German, sometimes *four* in a single page of ordinary matter; this throws some doubt on the accuracy of the printed Tables (which cover about 130 pp. folio). The complete Report must have included about 29 plates (constant reference being made to them), but only three are published; the absence of these plates makes it often difficult, sometimes impossible to follow the author's argument. Again, the want of uniform transliteration of proper names causes difficulty in identifying unfamiliar places, the same place being often spelt in two or more ways (*e.g.* Shoaygheen, Shwaygheen, Shwégveen, &c.). There is a too frequent use of local words (*e.g.* *choung* = river, *eng* = lake, &c.), and also of odd un-English words (*e.g.* divagation, prescinding, &c.). These are, however, trifling drawbacks compared with the fact that the work is one of great value, combining the results of unusual knowledge of the literature about the Irrawaddi with probably unique practical knowledge of the Irrawaddi Delta.

The work contains three very distinct subjects: 1, the question of the sources of the Irrawaddi (Parts I. and II.); 2, the hydraulic works on the Irrawaddi (Part III.) and Nawoon Rivers (Part IV.); 3, the theory of the flow of water in rivers (Parts III. and IV.).

Sources of the Irrawaddi.—Parts I. and II. form a monograph on the vexed question of the lower course of the great Thibetan River (Tsanpou or Sanpo); its upper course from west to east within the heart of the Himálya mountains has long been roughly known (by travellers' reports), but its lower course beyond the Himálya is still strangely obscure. The Indian Survey maps have long shown the Sanpo as continuous with the Brahmaputra. But the author adopts the view of the great French geographer, D'Anville (*circa* 1730), that the Sanpo is the upper course of the Irrawaddi. He discusses at great length the general features of the Thibetan plateau and of the Brahmaputra and Irrawaddi valleys, especially as to the distribution of mountain and valley, and as to rainfall and river discharges. The chief argument is that just above the *débouchure* of the highest known large affluent (the Mogoung), a little above Bhámo, at a distance of 800 miles from the sea, the Irrawaddi is still an immense river 1000 yards wide and with a flood discharge of over 1,000,000 cubic feet per second, and therefore requiring a large drainage area above Bhámo. Now within 100 miles above Bhámo, the five great rivers—Brahmaputra, Irrawaddi, Salween, Mekhong, and Yangtse-kiang—are known to be contained within a narrow strip of 200 miles width; from this it would seem that the sources of the Irrawaddi must be very distant (from the want of numerous large affluents). By collating the various travellers' accounts of the Sanpo, it is shown that they are consistent with its being continuous with the Irrawaddi.

Most of this appears to have been written in 1877. But in 1877-78 the Indian Survey Department conducted some special investigations on the question; their explorers traced the Sanpo downwards to within about 100 miles of the nearest regular survey party then at work on the affluents of the Brahmaputra near the limits of British

territory; this gap of 100 miles was left a *terra incognita*, so that the question was still open to conjecture. After some discussion of this later work, it is shown rather to favour the author's earlier writings.

Besides the main (geographical) argument there is much interesting matter in these two parts on the geology, meteorology, and some minor features of the Sanpo and Irrawaddi basins. The want of a good detailed map is much felt here in attempting to follow the geographical argument.

Hydraulic Works.—Parts III. and IV. deal chiefly with the (engineering question of) Embankment Works in the Delta of the Irrawaddi, intended for reclaiming the rich alluvial land and for shutting out flood water. In a practical sense this is much the most important part of the Report; but in the absence of the plates it is impossible to follow the great detail given. Still there is much of general interest admitting of some notice here.

Firstly, it is explained that most of the easily cultivable land in British Burma having been already taken up, the country—though apparently thinly populated—is actually well populated over the only good land; and that, to prevent over population, what is now really wanted is more land. In this view the reclamation of good land acquires great importance. This work in some way resembles that in the Mississippi Delta, with the important difference that the latter is a rich country with ample funds for the prosecution of large works, whilst Burma is a poor country without adequate means for the same. Indeed, the history of the works as herein set forth is throughout one of insufficient provision of funds for their rapid prosecution, and sometimes even for their proper repair; this was very disadvantageous, as of all works the timely repair of an embankment is perhaps the most urgent, as its breach may be simply disastrous.

In early days high floods on the Irrawaddi seem to have been rare; at any rate the floods of late years (1868, 1871, 1875, 1877, 1879) have all risen considerably above the highest supposed possible from local inquiry in 1862. It seems possible that this is due partly to the gradual destruction of the forests above, which causes the rainfall to be more violent while it lasts and also favours its rapid descent to the main stream, and partly to the erection of the embankments themselves which confine the floods to the main river.

A very curious instance is noticed that the 1875 and 1879 floods were *foretold* by the Burmese astrologers.

Flow of Water.—The uncertainty of hydraulic knowledge nowadays is well illustrated by the various opinions of successive engineers on the rise that would ensue in the river consequent on embanking it on both sides throughout the Delta. It is said that Col. Stoddard reported in 1869 that the rise would not exceed the average of one foot, whilst the professional adviser of Government considered that it might amount to 3 or 4 feet at Henzahda, and the author himself considered from 7 to 12 feet a probable rise. It is obvious that these results cannot be said to be any better than conjectural; their discrepancy showing that the formulæ in use for such sort of calculation were (as too often happens) inapplicable to the case in hand. The Government naturally declined to sanction the project.

The author then undertook an extensive series of direct

discharge-measurements of the river nearly on the lines of the Mississippi work, viz. by direct velocity-measurements at numerous points of certain selected sites. Besides the practical value of these as necessary data for the embankment projects, the details may be of great use in the study of the flow of water. And indeed this forms the most interesting portion of the work in a scientific sense, being a mass of original experiment on the flow in a mighty river. Much credit is due to the author for the zeal with which he had these experiments carried on for several years, in the face of great difficulties and discouragements. The experiments are discussed only so far as necessary to explain the application of the results (chiefly discharge-measurements) to the embankment projects. A further special report upon the experiments themselves is promised, which should be of great value.

The velocity-measurements appear to have been entirely made with the "double-float," whereof the surface-float was a wood disc 6"×6"×1" joined by a cord $\frac{1}{16}$ " thick, of various lengths, to a cylindric wood sub-float 6"×6"×12" loaded with clay, and sunk to various depths from 1 to 24 mètres. At moderate depths this instrument would be pretty efficient; unfortunately the efficiency of all double-floats decreases with the depth of immersion, and at the greatest depth of 24 mètres this one must have been very inefficient; for—supposing even that the sub-float retained its most favourable (the upright) position—the relative areas of connector and sub-float exposed to direct current-action would be as 73 to 100, and to lateral current-action as 52 to 100; so that the observed velocity of the instrument was certainly not that of the current at 24 metres depth (as it is taken to be). Notwithstanding the inherent objections to the double-float, there seems to be as yet no better instrument available for mighty rivers.

Two sorts of velocity-measurements were undertaken, viz. (1) at one metre depth at many points (from 30 to 60) across the channel; and (2) at every metre of depth upon selected verticals in the channel. The latter were considered the more important. This sort of work must necessarily have been very tedious in flood-seasons on a mighty river; at such times only ten complete series could be done daily; altogether about 10,000 such series were done. This is a collection of experimental data quite unique in river hydraulics, of which the author may justly be proud. From these data, together with the cross-section figure, the discharges were computed; the mode of computation seems to have been as good as the data admit of.

The mode of presenting the results is open to some objection—e.g. many of the velocities are carried to four decimals of feet per second, a degree of accuracy quite unattainable; again the discharges are given in several different forms, viz. in cubic feet per second, in cubic mètres, and also in tons and in "mètre-tons" per day, per month, and per year, and in some tables the unit is not stated. The author points out that one cubic metre of water weighs about $55 \div 56$ ths of a ton, so that the two measures (cubic mètres and tons) may be used indifferently with an error of less than 2 per cent., and he emphasises this coincidence by the use of a new term, "mètre-ton"; but by all modern usage this term means either the "moment of one ton of pressure at one foot leverage," or the "work done in raising one ton

weight through one foot height," so that this new usage is inconvenient.

As to the theory of running water some novel views are brought forward. It is stated that, speaking broadly, two theories of flow in open channels have existed; viz. that previous to Du Buat's time the motion had been supposed due solely to pressure, and since his time has been supposed due solely to surface-slope, so that the earlier formulæ involve pressure, and the later surface slope. The author himself is the advocate of a "new theory," viz. that the motion is due to both pressure and surface-slope; his arguments appear to be chiefly two, viz. (1) that formulæ involving only one of these elements all fail under varying conditions; (2) that in many cases the ratio of the deep-seated velocities to those near the surface (which is usually < 1) rises with increase of depth of the stream, and may sometimes even exceed unity in very deep streams. These views can hardly be admitted. Firstly, as to causality, surface-slope is really only a *property* of running water, not a *cause* of motion. All change of motion is due to and is evidence of the action of some *unbalanced* force (or pressure). In the case of running water the unbalanced active force (effective in forward motion) is the part of the earth's attraction *not directly* balanced by the normal resistances (ultimately of the margin), i.e. the resolved part thereof parallel to the motion, the *measure* of which is $g\rho \sin i$, and actually enters into all modern hydraulic formulæ in various equivalent forms, e.g. as $(p - p')$, $(d p \div d x) \cdot \delta x$, $g\rho(h - h')$, $g\rho \sin i$, $g\rho S$, &c.; it cannot therefore be said that pressure is excluded from modern formulæ (although, after substituting numerical values for $g\rho$, the evidence of it is apparently lost). In the argument it seems also to be implied that the increase of pressure due to increase of depth should cause increase of velocity, but the fact is that increase of pressure does not of itself affect motion at all, unless the increase be (at least in part) unbalanced.

An interesting series of discharge-measurements was made at three sites in concert, viz. at Saiktha, near the head of the Delta, and at Zaloon and Thapangyo, which are situate on the two largest Delta streams. There appear to be only some minor local *affluents* into and *effluents* out of the space between the upper and lower sites. It would seem therefore that the discharge-measurements at the upper and at the two lower sites together should be nearly equal; this affords a valuable test of the consistence of the results. The field work seems to have been done at *each* of the three sites on seventy-three days in 1872-73, thus giving seventy-three pretty complete results; other eighty-three days' results are also given, but these are partly interpolated, and therefore of less value. The discrepancies are sometimes very large, ranging from a *gain* of 27 per cent. to a *loss* of 15 per cent. in the daily results; most of them (97 out of 154) are on the side of gain. After making allowance for the utmost possible supply from the minor *affluents* between the sites (by adding in the whole rainfall all over their drainage-basins) the residual discrepancy is attributed to the "storage power" of the river area (about 305 square miles) between the sites. While there is no doubt some (temporary) "storage power," it seems more likely that most of the discrepancy is due to real error in the results themselves, the fact being that only *very rough* approxi-

mation can be expected in the discharge-measurement of mighty rivers in flood. This collection of river discharge-measurements being made in such a way as to test each other is almost unique, most published results being isolated results incapable of test.

ALLAN CUNNINGHAM

OUR BOOK SHELF

The Botanical Atlas; a Guide to the Practical Study of Plants. By D. McAlpine, F.C.S. (Edinburgh: W. and A. K. Johnston, 1882.)

THE above is the title of a publication appearing in monthly parts, each containing, in the words of the prospectus, "four beautifully coloured plates and descriptive letterpress." Part I. deals with common representatives of the natural orders *Caryophyllaceæ*, *Cruciferae*, *Fumariaceæ*, *Geraniaceæ*, and *Labiatae*.

We are perplexed as to the intentions of the author of this work, which is advertised as designed "for the use of medical schools and Universities." If the "Botanical Atlas" is intended to supply candidates for certain elementary examinations with the facts absolutely necessary for a "pass" certificate, it seems fair to expect accuracy in the drawings of common objects.

The author, however, appears to think otherwise; not only are there gross inaccuracies in the execution of the conspicuous figures, but the types are ill-chosen and imperfectly referred to.

In illustration of this may be noted Fig. 2, on Pl. xiv., professing to represent a vertical section of the common wallflower; the reference "long stamen," points to the anther of a short one, and the words "short stamen," are referred to a green band, which might be imagined as intended for filament, petal, or sepal, and seems to do duty for all three.

In the figures standing for other vertical sections of flowers—e.g. Fig. 3, Pl. xvi., and Figs. 2 and 3, Pl. xxiii.—no one can avoid noticing the mysterious vagueness in the lower portions of the drawings; the same remark applies to the sections on Pl. xv. Is the author undetermined as to the relations of the parts composing the andræcium and gynæcium, or does he expect students, for whom elaborately-coloured drawings of sepals and petals have been prepared, to discover the forms and relations of the smaller essential organs without aid—or, rather, in spite of the misleading caricatures here placed like pitfalls in his path?

Similar faults are apparent in the diagrammatic plans of the flowers, and one wonders at the ingenuity displayed in going so far out of the way to prepare imperfect and inaccurate drawings of common objects.

Among other equally ingenious misrepresentations may be named Figs. 9 and 10, Pl. xv.—the marvellous streaks in a somewhat oval frame (Fig. 11, Pl. xvi.) supposed to represent a longitudinal section of the seed of *Geranium*, the incomprehensible *stigma* in Fig. 8, Pl. xxiii., with reference to which we cannot agree with the author when he says: "The figures will show the arrangement of the parts better than any description."

Passing over such errors as *Nostoe*, *Hydrodictyon*—possibly printer's mistakes—and the questionable mixtures of Latin and English names, we may notice one or two specimens of description appended to these gaily-tinted plates. We are told, without further remark: "The form and arrangement of the different parts (Fumitory) are evidently suggestive of some purpose." Also, the description of the wallflower commences: "Wallflower is a universal favourite, no less from its beautiful colour than from its sweet smell," and then passes on to a highly condensed and imperfect synopsis. We are told that the "Campion" "also smells in the evening in order to guide and attract insects," and that in Herb

Robert "the stem forks a deal, and is very brittle at the joints."

Such drawings and writing speak for themselves. We can only express the hope that if the other parts are published, more attention will be paid to accurate delineation and exhaustive description, and less to merely gaudy colouring. So far, the "Botanical Atlas" must be considered as but a very inefficient and faulty "guide to the practical study of plants." W.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

The Magnetic Storms of 1882, April

THE Astronomer Royal having received from Mr. Charles Carpmæl, superintendent of the Meteorological Office at Toronto, Canada, copies of the Toronto records of the double magnetic storm of April last, has had them compared generally with the Greenwich records. Some results of this comparison I am desired by him to communicate to you for insertion, if you think proper, in the columns of NATURE.

The records comprise traces of the changes of magnetic declination, horizontal force, and vertical force. The commencement of disturbance on April 16 was sudden, in all elements, as was also the renewal of disturbance on April 19. Measuring out the times, both for Greenwich and Toronto, the following results are found:—

Element.	Toronto time of commencement of disturbance.	Corresponding Greenwich time.		Greenwich time of commencement of disturbance.
		h. m.	h. m.	
Declination ...	April 16, 6 17 ...	16, 11 35 ...	April 16, 11 31	
Hor. Force ...	" 6 15 ...	" 11 33 ...	" 11 31	
Ver. Force ...	" 6 16 ...	" 11 34 ...	" 11 35	

Means ... April 16, 11 34 ... April 16, 11 32

Declination ...	April 19, 10 15 ...	19, 15 33 ...	April 19, 15 34	
Hor. Force ...	" 10 16 ...	" 15 34 ...	" 15 34	
Ver. Force ...	" 10 16 ...	" 15 34 ...	" 15 37	

Means ... April 19, 15 34 ... April 19, 15 35

The times are mean solar. In the first case the mean of the Greenwich times is but 2m. earlier than that of the reduced Toronto times; in the second case 1m. later, indicating no real difference. This confirms, what has been before observed, that in times of storm the commencement of disturbance at different places appears to be simultaneous.

As regards the variations registered during the progress of the storm there does not seem to be any very close correspondence between the records of the two places excepting in one particular, the occurrence of a very remarkable decrease of horizontal force, soon after the first outbreak on April 16, which continued for some hours, and is a striking feature in both records.

WILLIAM ELLIS

Royal Observatory, Greenwich, June 16

Earthquakes in China

PLUSIEURS secousses de tremblement de terre ressenties en Chine pendant l'année 1881 ont été rapportées dans les journaux de Shanghai, de Hongkong et de l'étranger. Voici sur deux d'entr'eux quelques circonstances toutes particulières qui sont venues à ma connaissance et dont on n'a pas parlé.

Le 20 Juillet, un peu après 9h du soir, une secousse assez forte ébranla la ville de Tchong-kin, capitale de la Province de Szechuen, longitude 104° E. de Paris; immédiatement après, écrit un Missionnaire, la ville fut couverte d'une brume tellement dense qu'on ne voyait pas à 10 pieds devant soi; de plus une odeur de soufre très sensible se répandit partout. On prit tout d'abord cette brume et cette odeur pour un indice d'incendie;