indeed, generally white but sometimes black, bred about Lassa; wool very fine and like the shawl wool. 4th. Changumpo Look, abundant about Geroo and in Dingcham, generally very large; the white wool very fine and soft. The flesh of all these sheep is fine-grained and good.

Of the *Phák* or pig there are two varieties, the southern pig, which is similar to the Indian village pig, and the small Chinese pig. There are no wild hogs in Thibet. The Chinese butchers at Lassa blow their pork so as to give it a deceptively fine appearance.

Ducks and geese are not eaten by the Thibetans, but are greatly used by the Chinese, for whom they are specially bred in Lassa.

The lakes of Thibet are full of fish, of which only one kind, named *Choolap*, is described; it grows to the weight of 8lb., and is a coarse food. It is, however, caught and preserved largely; the fish being gutted, split up, the tail put in the mouth, and dried, without salt, in the open air. Thus prepared they will keep for a year. The mode of catching them is singular; when the lakes are frozen over, a hole is made in the ice, to which they rush in such abundance that they are pulled out by the hand.

There are no leeches or mosquitoes in Thibet, nor are maggots or fleas ever seen there; and in Dingcham or Thibet Proper there are no bees or wasps.

Dr. Campbell gives us some very interesting information regarding the food of the Thibetans. During the summer months they use very little fresh meat. They do not like it boiled, and are not partial to it raw, unless it has been dried. In November there is a great slaughter, and a wealthy man, who has perhaps 7,000 sheep, will kill 200 at this time for his year's consumption. The animal after being killed is skinned and gutted and then placed on its feet in a free current of air. In a couple of days it becomes quite hard and is then ready for eating. It is kept in this way for more than a year without spoiling, even during the rainy periods. When long exposed to the wind of Thibet it becomes so dry that it may be rolled into powder between the hands. In this state it is mixed with water and drunk, and used in various other ways. The Thibetans eat animal food in endless forms, and a large portion of the people live on nothing else. The livers of sheep and other animals are similarly dried or frozen, and are much prized, but to strangers they are very distasteful for their bitterness and hardness. The fat is dried, packed in the stomachs, and then sent to market or kept for home use.

With regard to edible vegetables, it is stated that wheat, barley, and buckwheat sown in April or May and irrigated, are reaped in September, barley in Thibet taking the place of potatoes in Ireland, four-fifths of the population living on it. Besides these, the other crops are composed of peas, turnips, and a little mustard. The grain is ground in water mills. The bread is all unleavened, and cooked on heated stoves or gridirons. The sweet pure farinaceous taste of the fine flour equals the best American produce. The staple food of the country is *champa*, called *suttoo* in India; it is finely-ground flour of toasted barley. It is much eaten without further cooking; mixed up with hot tea it is called *paak*, and when prepared with tepid water it is known as *seu*. If any of our readers wish to enter upon "pastures new" in the breakfast department, they may try *Tookpa*, which, to be properly appreciated, should be taken at daybreak before any matutinal ablutions. It is a sort of broth made with mutton, champa, dry curds, butter, salt, and turnips.

Goats are also reared in considerable flocks, but for their milk rather than their flesh. The milk of yaks, cows, sheep, and goats is used alike for making dried curds and the various preparations of milk used by these people. Mares' milk is not used in Eastern Thibet.

We now proceed to notice the mineral wealth of this remarkable country.

Pen, a carbonate of soda, is abundant south of the Yaroo; it appears in a whitish powder on the soil, never in masses underground. It is not used for soap-making or otherwise in the arts, but is always put into the water when tea is made, and is much employed medicinally.

Chulla, borax, is only obtained north of the Yaroo, whence it is imported to other parts of Thibet, to India, *viâ* Nepaul, Sikkim, and Bootana, and thence to Calcutta and Europe.

Sicha, saltpetre, is abundantly manufactured in the Cara Thibetan sheep folds, where composts of sheep's dung and earth are found to produce it.

Lencha, common salt, occurs in commerce in three forms, viz.: *Sercha*, white and best; *Chámа*, reddish and good; and *Pencha*, yellowish and bad, containing soda or magnesia and earthy matter. All the salt used in Eastern Thibet is the produce of the lakes and mines north of the Garoo, or comes from Lache, a district between Digarchi and Ladak. According to the best information, all the salt is the produce of lakes, while some assert that it is dug out of the earth. It is certain that the salt-producing districts are all but inaccessible, and can only be traversed by men and sheep; and that their elevation prevents the working from being carried on except in the warmer part of the year, from April to November. Thousands of sheep are employed in carrying the salt to places accessible to yaks, the former animals carrying a load of 20lb. to 24lb. on open places, or of 8lb. to 10lb. in the rugged vicinity of the deposits, whose elevation is not less than 22,000 feet, while the latter are capable of bearing a load of 160lb.

Ser, gold, is found in the sands of a feeder of the Garoo, on its northern side, but the name of the river could not be ascertained by Dr. Campbell. The Garoo itself does not yield any gold washings. Most of the gold of Thibet is the produce of mines or diggings.*

Pabea, the yellow arsenic of commerce, is found west of Lassa, near the borders of China.

There are no mines of iron, silver, copper, quicksilver, lead, or coal in Thibet; the latter substance is, however, imported from China.

The turquoise, real or artificial, is universally worn in rings, necklaces, &c., and large, amber-like beads are a favourite ornament; but it is uncertain whether they are natural products of Thibet. The latter are apparently composed of turpentine mixed with some hardening material. Numerous imitations of turquoise are imported from China; and real but not valuable stones are sent, *viâ* Cashmere (but from what locality is not stated). The only test of a real stone that is resorted to by the Thibetans is to make a fowl swallow it; if real it will pass through unchanged.

In conclusion, we may add that Dr. Campbell's articles in *The Phœnix* contain much valuable matter on the geography, the government, and army of Thibet, the personal habits, customs, and ceremonies of the Thibetans, their religious festivals, the seasons, soil, and agriculture of the country, the wages of labour, and the most prevalent diseases. Amongst "Things not generally known," we may mention *Goomtook*, or *The laughing disease*, which consists of violent fits of laughter with excruciating pain in the throat. It equally attacks men and women, and often proves fatal in a few days.

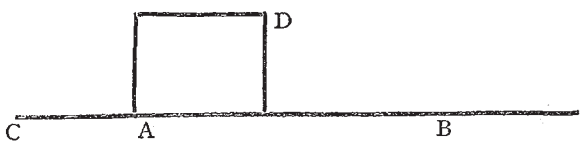
ON THE CAUSE OF FIXED BAROMETRIC VARIATIONS

THE chief difficulty in the way of explaining the annual and diurnal variations of the barometer by the heating and cooling of the air, appears to be the existence of a double maximum and minimum. To show how such a double maximum and minimum might result from the

* Notices of the Thibetan Gold Mines may be found in several recent numbers of the "Proceedings of the Royal Geographical Society."

changes in the temperature of the dry air alone, is the object of the present paper. I commence with the diurnal variation.

Let us suppose an atmosphere of dry air hardly absorbing any heat from the solar rays, and therefore chiefly heated and cooled by contact with the earth. Let us take the moment when the earth first begins to be heated by the sun's rays. (This will probably take place a little before sunrise, in consequence of the large amount of reflected or diffused heat which accompanies the morning twilight.) The earth then becomes heated at A, while at B, a little more to the west, no heat is yet felt. The earth



at A communicates its heat to the air in contact with it, and the latter expands and becomes lighter than the air in contact with the earth at B. (At C of course the earth is more highly heated than at A, and therefore the air in contact with the earth at C is still lighter.) The immediate consequence is that the heavier air at B rushes into the heated space A D (see fig.), driving out the lighter air which occupies it; and A D becoming filled with heavier air than before, the barometer at A rises. The heating goes on however at A, which remains at a higher temperature than B, until the epoch of greatest heat arrives; and consequently during all this time there is a flow of air from B towards A next the earth, with a flow in the contrary direction at a greater elevation. It might at first sight appear that the barometer at A would go on rising all this time. But a moment's reflection will show us that though it does so at first, it could not continue to do so all through. For as at the epoch of greatest cold (with which we commenced) C, A, and B were sensibly at the same temperature, so they will arrive at sensibly the same temperature at the epoch of greatest heat; and immediately afterwards the direction of the under-current will be reversed, C having become colder than A, while B is hotter. It is therefore evident that during the whole time which has elapsed between the epochs of greatest cold and greatest heat, the two currents will have counter-balanced each other, the under-current having carried exactly as much air from B to A as the upper-current has carried from A to B. Making a somewhat rough approximation, we may assume that during the first half of this period the under-current has been in excess, and the barometer at A has risen, while in the latter half the upper-current has been in excess, and the barometer at A has been falling. Immediately after the epoch of greatest heat, the cooler and heavier air at C will displace the air in the space A D, causing the barometer at A to rise. The moment of greatest heat will, therefore, correspond to a minimum reading of the barometer, not a maximum; and after it the barometer will go on rising until half way between it and the moment of greatest cold, when it will again fall until the latter moment. The barometer will, therefore, attain its minimum height at the hours of greatest heat and greatest cold, while the maximum heights will occur at about halfway between these epochs. Now this result appears to conform exactly to observation. It must be recollected that the minimum of temperature occurs not more than half an hour before sunrise, while the maximum is generally not reached for two or three hours after noon. This will explain why the morning barometric maximum seems to be nearly an hour earlier than the evening one. Indeed observation corresponds so exactly with the results arrived at, that I think it will appear that they cannot be seriously modified by the presence of aqueous vapour.

The mean of barometric pressures at different latitudes confirms these results. If the trade-winds extended to the poles—which they probably would do were it not that the parallels of latitude become so narrow before reaching them—on the same principles we might expect a minimum of pressure at the equator and the poles with a maximum at a latitude of about 45°. For the second of these minima we must evidently substitute the limit of the trades, or rather perhaps of the anti-trades, since the latter seem ultimately to become the under-currents; and our maximum will be situated about halfway between this limit and the equator. This agrees with observation. The phenomena of the tides too are analogous. There is low water where the moon's attraction is strongest and where it is feeblest, while high water corresponds to the mean attraction. Putting heat for attraction and the sun for the moon, the diurnal variations of the barometer follow the same law.

This law, however, does not appear to hold so well for the annual barometric changes. We can hardly trace in this case a double maximum in May and November, with minima in January and July. I think, however, that this result may be in part at least explained by the northern and southern shifting of the system of trades and anti-trades. For example, if a place in the northern hemisphere be near this limit (which corresponds to a minimum), the southern movement of the system in winter may cause the barometer to rise instead of falling as we approach the coldest day (supposing of course that it lies to the north of it). On the other hand, at a locality a little to the south of the limit, the northern movement of the system in summer may cause the barometer to rise at the time of greatest heat. I should perhaps notice, however, that the results here arrived at suppose the three points A, B, C to be situated on a horizontal plane, and the specific heat and conductibility of the earth at each of these points to be nearly identical. Hence they cannot be expected to hold for very elevated positions, or for places situated on the sea coast, or the shores of a large lake. They will be found most accurate in the interior of continents, where the land is level, and where the amount of aqueous vapour in the air is comparatively small. This anticipation is also verified by observation, so far as my knowledge reaches.

W. H. S. MONCK

*REMARKS ON THE ADAPTIVE COLOURATION OF MOLLUSCA**

NATURALISTS have long recognised the curious cases oftentimes occurring, of the resemblance between the colour of an animal and its immediate surroundings. It had been supposed that climatic influences, or peculiarities of food, or greater or less access to light, had something to do with these coincidences. Mr. Alfred R. Wallace has shown that the varied phases of these phenomena could not be explained by such agents, and in a paper "On Mimicry and other protective resemblances among Animals," published in the *Westminster Review*, July 1867, and since made widely public in his work on "Natural Selection," he shows that the singular resemblances between the colour of animals and their surroundings are mainly brought about by the protection afforded them through greater concealment. Many very interesting examples are then cited from the Vertebrates and Articulates in support of these views. Briefly may be mentioned, as examples, the almost universal sand colour of those animals inhabiting desert tracts; the white colour of those animals living amid perpetual snows; the resemblance seen again and again between the colour of many insects and the places they frequent. Among the hosts of examples cited by Mr. Wallace as illustrating plainly the views he advances, may be mentioned the

* From the Proceedings of the Boston Society of Natural History, vol. xiv., April 5, 1871.