(2) Rocks without open joints, in which the constituent mineral particles are fairly large and the pores between them wide enough for water to filter slowly through. Road sites on these foundations are sufficiently well protected from the accumulation of excess of water by the provision of adequate lateral drains.

(3) Rocks fine-grained and argillaceous. These, the clay rocks, consist in large part of minute flakes of mica, and owe such strength as they possess to the air-water films which bind them. These have mostly originated as mud upon the sea bottom, but as found in mines and deep cuttings, by reason of the pressure of overlying strata, they have lost much of their water and become strong. Exposed to the atmosphere for long periods, in the soil, or kept in contact with water, they "fall" to slime or incoherent mud, and while they are "falling" they develop the properties of a viscous fluid. Kept dry they retain their strength, and some of them if laid bare in dry weather may increase in strength. By reason of the fineness of their grain they are well-nigh impervious to the percolation of water, and any water which comes upon them either is absorbed to the diminution of the strength of the clay it wets, or, diverted by the impervious surface, flows away under gravity. Though the process of absorption is more or less slow, it is continuous and sure, and whenever a load is borne upon a surface of clay which is kept constantly wetted there must eventually come a collapse.

Landslips generally occur on hillsides where a clay foundation supports more massive rock, and, becoming wetted by trickling water, can withstand their load no longer. Road sites of argillaceous rock must therefore be guarded with special care from the action of water. Lateral drains are the best preventive against the water from outside, but the American method of shaping clay road sites with a plough and compacting them to a camber with a steam roller before making up the road at all, is one which commends itself to the geologist as a means of conducting away the water which enters from above. Upon the cambered clay surface sufficient of a coarse-textured make-up layer must be provided to distribute the pressure of traffic over a wide base, and to act as an open drain to the water which sipes in through the road-crust.

Many of the worst roads are along outcrops where pervious and impervious rocks meet, and it would be well if those whose profession it is to plan new roads could avoid such localities. Springs occur at these places, some of them with continuous flow, others rising intermittently as bournes only when the level of ground water in the porous strata comes to the surface; and if here the road be founded upon a clay rock which loses its strength by wetting, trouble must ensue. In any case the access of ground water to the road crust cannot do other than impair the wearing power of the road.

Variation in the Properties of Water.

The lecturer noted first the changes of vapour pressure. By reason of the changes in the maximum pressure which water vapour can sustain, there is the phenomena of dew and hoar-frost, and, for the matter of that, all the phenomena which accompany and control the humidity of the atmosphere and the precipitation of rain. These, and the influence they exert on the production and laying of surface dust, so force themselves on the notice of road makers that they are always watched for, and as far as possible kept in check by the surveyor's arrangements for the disposal of excess, and for the supplementing of any deficiency of water.

Before leaving this subject he drew attention to the influence which the surface form of the water has upon the temperature of saturation. This influence has been well studied in the case of rain-drops, but seems to have passed unnoticed in the case of the water surfaces among the crannies of stones, where films of water are giving strength to clay or binding macadam together. The dew-point for convex surfaces is lower than that for flat ones, and, again, the dew-point for concave surfaces is correspondingly high, rising the more in proportion as the curvature (that is, the narrowness of the cranny) is increased. Who has not noticed that the large pebbles on a beach dry more quickly than does the sand? Who does not know that a sandy soil remains damp less long than a field of clay? It is all a matter of curvature of the water surfaces. For the same reason a new-coated road, in which all the surface particles are still large, remains unaffected by dew or incipient fog long after an old and well-trafficked road has been reduced to a condition ideal for a skid.

Flint, as has been already seen, behaves as a material which water does not wet, and between flint fragments the water stands in globules. Flint roads, therefore, do not become slimy under the action of dew, and, despite its excellence as a "puncture mixture," there is no more efficient material than flint grit for sprinkling on wet and dirty roads to reduce the slipperiness.

Sub-Crust Dew.

There remains also the important question of sub-crust dew, which "droppeth" not "as the gentle rain from heaven," but rises or transpires from "the waters under the earth" whenever the outside atmospheric temperature falls below that of the rocks within. Like normal dew, when it arrives at the cooled surface, it precipitates itself upon the water films, and, increasing the proportion of the water beyond the optimum, reduces and perhaps altogether destroys the strength of the road crust. Each autumn we see water-bound roads which have been strong all the summer going to pieces from this cause; they seem as if they will never dry. Roads dry and good before a frost are notably wet and unpleasant when the thaw comes, and this whether or not rain has fallen in the interval. Tar-painted and other roads with waterproofed surfaces are just as bad as unpainted ones with respect to this, and, indeed, the over-wetting of well-drained water-bound roads after a frost is only rendered possible by the sealing of the outward ends of the air passage by ice, a sealing which by design is already accomplished in the process of waterproof painting. As to means of preventing the ravages of sub-crust dew, Professor Fearnsides had nothing to suggest; but said that just in proportion as the source of the warm underground water is easy or difficult of access, so is the process of surface condensation immediate or delayed.

Efficient sub-crust drainage is therefore important, not only for keeping up the general strength of the road crust, but also because it delays the arrival of the winter's damp, and so secures that the proportion of days when the road's optimum strength is reduced is kept as low as possible.

The Phenomena of Frost.

Frost swells the water which is contained in narrow places, and whether the narrow places are cracks within the stones or crannies in which the water is at work binding the stones together the water must expand,