now, with a recent paper by Reichman and Penman (*Proc. natn. Acad. Sci., U.S.A.*, **70**, 2678; 1973), does it show any signs of being overcome.

Earlier work by Penman's group had shown that HeLa cells incubated at 42° C recover from the inhibition of initiation after 1–2 h. This recovery is prevented by actinomycin D, but not by cycloheximide, and, in fact, preincubation of cells at 37° C with low doses of this drug makes them less susceptible to inhibition of initiation at 42° C. These and other results suggested that when protein synthesis is slowed down, for example by high temperature, amino acid starvation or cycloheximide, the cells respond by making an RNA which promotes initiation. This RNA was predicted to have a half-life of about 1 h and to be rate-limiting for initiation in certain conditions.

When Reichman and Penman first tested extracts of normal HeLa cells for initiation *in vitro* they, like many others before, found very low activity, as measured by the pactamycin-sensitive incorporation of (^{35}S)-methionine into the N-terminal position of polysomal-bound nascent protein at 25° C. Bearing the earlier results in mind, however, they preincubated their cells for up to 4 h in the presence of a low concentration of cycloheximide and then prepared cell-free extracts, which showed up to six times more initiation. This increase in initiating capacity was prevented by preincubation with cycloheximide and actinomycin D, but was obtained when cells were preincubated in the absence of an essential amino acid. Developing the earlier model, Reichman and Penman suggest that the factor synthesised by intact cells in response to a reduction in protein synthesis is also the factor which is rate limiting for initiation in cell-free extracts, but they are somewhat more cautious in predicting that the factor is an RNA species. Although preliminary, these results open up exciting new possibilities for studying the control of initiation in mammalian cells.

PEAT

Origin of Palsa Mounds

from our Plant Ecology Correspondent

The energy exchange properties of palsa mounds is the subject of a recent paper by Railton and Sparling (*Can. J. Bot.*, **51**, 1037; 1973), who provide a new approach towards understanding these mounds of peat with frozen cores which are abundant in the mires of high latitudes.

The word 'palsa' originated in Lapland and most of the research which has been undertaken on these features has come from Finland and the Soviet Union. In Finland palsas are only found north of the coniferous forest limit in areas with a mean annual air temperature of −1° C and an annual precipitation of less than 400 mm. The palsas of that region are often irregularly shaped and may attain lengths of 200 m.

In the search for an explanation of the origin of these phenomena an initial question requiring solution is the start of their formation. By means of pollen analysis accompanied by radiocarbon dating, Salmi (*Proc. 3rd Int. Peat Congr., Quebec*, 182; 1968) came to the conclusion that palsas in Lapland fall into two groups, one of which began formation around 5000 BC and the other at about 3000 BC. The age of a palsa, however, did not seem to be related to its size. Other Finnish workers have found palsas of more recent origin and are less inclined to regard palsas as relics of past climates.

Railton and Sparling align themselves with those who believe in a continuous cycle of formation and erosion of the palsa mounds. They base this belief on their observation that all size classes of palsas are represented in their study area in northern Ontario and also that these classes exhibit a complete intergradation. They do not attempt to justify the assumption that palsa size is a function of palsa age, an assumption which appears rather tenuous in the light of Salmi's work.

They do, however, demonstrate some interesting relationships between palsa size and vegetation cover. Palsas containing a high percentage cover of *Sphagnum fuscum* were mainly less than 60 cm high and less than 7 m long. Lichen-rich communities with, for example, *Cladonia alpestris*, *C. floerkeana*, *C. rangiferina*, were found mainly on mounds greater than 60 cm in height. On the basis of these observations Railton and Sparling suggest that palsas develop continuously, and probably originate as *Sphagnum fuscum* hummocks on the mire surface. They become invaded and dominated by lichens during growth and finally erode and collapse. It is possible that the changes in heat exchange properties associated with the development of a lichen cover could account for the process of palsa development.

To test the feasibility of such a model Railton and Sparling measured the energy exchange properties of the different vegetation types. Total albedo was least on the general mire surface, increased in the *Sphagnum fuscum* hummocks, was greater still in hummocks dominated by lichens and reached a maximum in mature palsas. The obvious question which follows is whether these increases in albedo associated with palsa development are adequate to account for their negative heat budget and hence their growth. A consideration of the total energy budgets of palsas led Railton and Sparling to the conclusion that the differences in albedo were not sufficiently great when compared with other energy exchange factors, and they are inclined to regard changes in the soil heat flux as being of greater importance. Thermal conductivity in peat decreases as the peat dries. Drier peat on the top of hummocks would lose heat less rapidly in summer, so helping to preserve the permafrost core. If this is so, then the lichen cover so often associated with mature palsas should be regarded as a product of mound development rather than a cause.

PLATE TECTONICS

Subduction Heating

from our Geomagnetism Correspondent

According to the hypotheses of the new global tectonics, oceanic trenches, where colder oceanic lithosphere descends into the warmer underlying mantle, should be regions of relatively low surface heat flow; and this prediction is generally confirmed by observation. But observation also shows that behind oceanic trenches (that is, on the side of the trench opposite the spreading ocean floor) the heat flow is above average and associated with the volcanic island arcs. For some years after the basic principles of seafloor spreading and mantle convection had been mapped out, the causes of the volcanism and high heat flow, though clearly related in some way to global tectonic processes, remained obscure, and even today are far from being completely understood. In 1968, however, Oxburgh and Turcotte (*Nature*, **216**, 1041; 1968) and McKenzie and Sclater (*J. geophys. Res.*, **73**, 3173; 1968) made a significant advance by proposing independently that the origin of behind-trench phenomena lies in frictional heating on the slip zone between the descending lithospheric plate and the overlying mantle.

Such frictional heating certainly seems to be able to account for the surface observations behind oceanic trenches; and so several workers have attempted in various ways to calculate the subsurface temperature distribution in the descending plate. Turcotte and Oxburgh (*Phys. Earth planet. Inter.*, **1**, 381; 1968) and McKenzie (*Geophys. J.*, **18**, 1; 1969), for example, assumed in their calculations that the temperature is constant at the slip zone, whereas in later work McKenzie (*Tectonophysics*, **10**, 357; 1970) and Griggs (in *The Nature of the Solid Earth*, McGraw-Hill; 1972) assumed the slip zone temperature to be equal to that of an undisturbed mantle. Then again, Oxburgh and Turcotte (*Bull. geol. Soc. Am.* **81**, 1665; 1970) assumed that the