novel plants should be seen as complements to, not as substitutes for, conventional tropical crops. It also acknowledges that the problems of exploiting new plants are not just horticultural, but are economic and sociological: new crops depend on the creation of new markets. □

Nucleon coalescence

from P. E. Hodgson

RECENT experiments on the interaction of relativistic heavy ions with silver and uranium have provided evidence that the emitted nucleons tend to stick together to form composite particles, so that the numbers of high energy ^{3}He and ^{4}He particles are two or three orders of magnitude greater than those found for proton-induced reactions at comparable velocities. It was found that more ^{3}He were emitted than ^{4}He, and this made it doubtful whether both their emission could be explained by the same process.

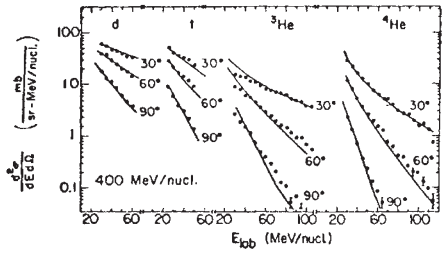
To study this matter in more detail, Gutbrod and colleagues (*Phys. Rev. Lett.*, **37**, 667; 1976) have measured the energy spectra at several angles of the protons, deuterons, tritons, helions (^{3}He) and alpha particles (^{4}He) emitted when uranium is bombarded with 250, 400 and 2,100 MeV per nucleon ^{20}Ne ions and with 400 MeV per nucleon alpha particles, and some typical results are shown in the figure.

To try to account for these distributions, they developed a theory that had already been used by Butler and Pearson to explain the observation of high energy deuterons emitted from nuclei bombarded with energetic protons. This theory assumes that among the cascade of nucleons emitted from such reactions there will be some neutron–proton pairs with rather low relative momenta. The nucleons of each pair can interact with each other and with the surrounding nuclear field to form a deuteron, the nuclear field serving to absorb excess energy and momenta. This model enables the energy spectra of the deuterons to be calculated from that of the cascade nucleons.

The theory was modified to calculate the spectra of the lighter particles emitted from relativistic heavy ion collisions, and the results are compared in the figure with the experimental data. It is seen that the overall features are accounted for very well.

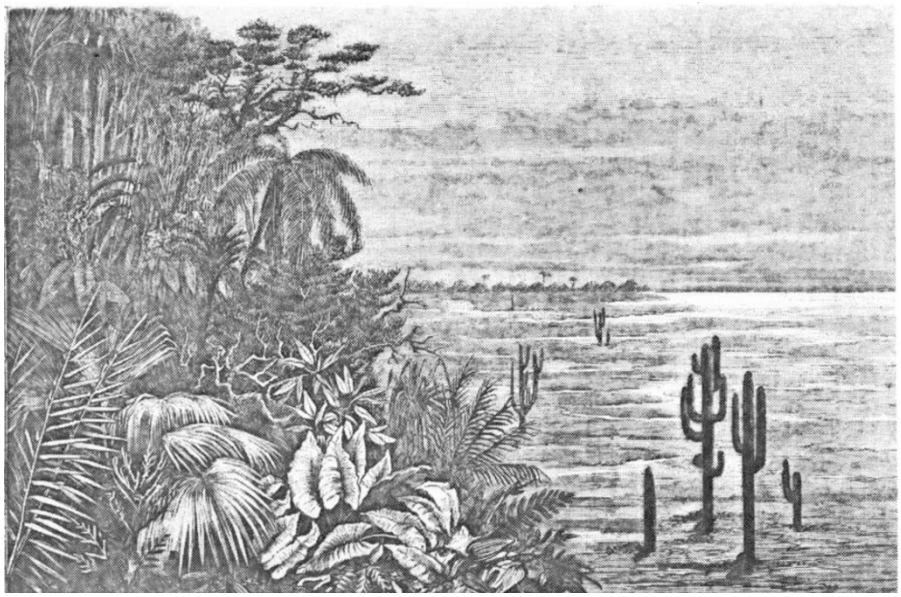
An important parameter of the theory is the greatest relative momentum between the neutron and the proton for which they can coalesce. This momentum was adjusted for each of the reactions investigated so as to give the best overall fit to the experimental data, and it was found that the best values were around 130 MeV/c in each case. This constancy checks the validity of the theory.

It still remains to understand the details of the mechanism of nucleon coalescence, but it is certainly encouraging that a relatively simple theory can account so well for so much experimental data relating to very complicated reactions.



Experimental energy spectra of the deuterons (d), tritons (t), helions (^{3}He) and alpha particles (^{4}He) emitted from uranium irradiated by ^{20}Ne ions at 400 MeV per nucleon.

A hundred years ago



TROPICAL FORESTS IN HAMPSHIRE. The Valley of the Bourne restored to represent the conditions which are supposed to have existed during the deposition of the Lower Bagshot Formation: Looking at the scene from a southern standpoint we should see to the north the distant chalk range. Whilst along the shore of the opposite bank of the valley we could with some difficulty detect the various forms of vegetation, which we should see with greater clearness in the more immediate foreground. In this valley a singular stillness must have prevailed, as no trace of animal life whatever has been found, except a feather and a few insect wings blown in from the southern bank.

Of the following at least we are pretty sure, and of numerous others we can be almost sure, but there are indications of very many besides, the relationships of which are at present but imperfectly defined.

Here we should see the graceful fan-palm and the feather palms, adding softness to the view by their elegantly-curved and drooping leaves, laurel and dwarfed oak, stately beeches, clumps of feathery acacia, trellised and festooned with smilax, the trailing aroid, with its large and glossy foliage and an undergrowth of *Mimosa* and of cypress in the swampier ground, and variations in colour caused by the foliage of cinnamon and fig, and the ground clothed with ferns and sedges. On the barren sands of the distant valley are growing clumps of giant and weird-looking cactus. It is not difficult to picture to ourselves the view.

All this beauty is gone. We have nothing but these records of what must have been a view of great loveliness, which only the toil of the geologist can even faintly reproduce.

From *Nature*, **15**, January 18, 261; 1877.