The muon energy range of real interest is that above the 10 or so GeV at present available from accelerators and it is important, for purposes of analysis, to reduce the relatively large number of low energy muons incident on the Earth at sea level. This is done by putting the apparatus in a cave and pointing it through the Castle Rock in such a way that muons which arrive within the acceptance solid-angle suffer an energy loss of about 50 GeV. The resulting "apparatus" spectrum displays a much reduced proportion of low energy particles.

To minimize systematic errors, no interaction selection system will be used so that the trajectories of all muons traversing the apparatus will be photographed and subsequently scanned. Because of the large amount of target material, as many as one in two hundred traversals will result in an interaction of interest (a total rate of 120 per year). The identity of the interaction products can be established by their subsequent behaviour as they pass through the stack.

One of the most important and interesting deductions which can be made from the results is the real photonuclear cross-section at high energies which, according to present indications, starts to fall at photon energies of a few GeV (Hodgson *et al.*, *Proc. Tenth International Conference on Cosmic Rays*, Part 2, S373; 1968).

Work by the Utah group using the prototype of their underground neutrino detector (Morris and Stenerson, *Nuovo Cimento*, **53**B, 494; 1968) indicates that the electromagnetic production of muon pairs by muons will be observable with the present apparatus, albeit infrequently; it will be possible to identify the muons unambiguously and to measure the energies involved accurately. Ultimately these interactions could provide a useful test for the predictions of quantum electrodynamics.

TECTONICS

Ocean Basin Isostasy

from our Geomagnetism Correspondent

R. K. MATTHEWS has recently posed the following question: Because continents and continental margins respond isostatically to pressure variations of ten bars or less, can we expect ocean basins to respond similarly (*Earth and Planetary Science Letters*, **5**, 459; 1969)? The idea is not completely new; but since geophysicists are now willing to accept large scale movements of mantle material to account for such phenomena as continental drift and ocean floor spreading, Matthews suggests that the tectonic implications of isostatic adjustment of ocean basins deserve renewed consideration.

The basis of Matthews's work is a model to explain the consequences of a eustatic lowering of the sea level accompanying a period of continental glaciation. Continental margins which are not adjacent to a glaciated continent will rise isostatically because of reduced water cover. A shoreline feature will thus be recorded on continental margins and oceanic islands at the same equilibrium level. But if the removal of water also causes the ocean basins to rise isostatically, though more slowly than the continental margins, the sea level will rise with respect to the continental margins but not with respect to the oceanic islands which are fixed to the ocean floor. A new shoreline feature will then be produced on the continental margins higher than the first but at the new level of the previous oceanic island shoreline. Following the eustatic sea level rise accompanying continental deglaciation, it should then be possible to observe two closely spaced ancient shoreline features on the continental margins but only one on the oceanic islands.

Does this model accord with observation? Matthews considers the data from two continental margins and one oceanic island at the time of the Wisconsin glaciation. The Texas Gulf coast shows a low sea level at 120 metres represented by high erosional escarpments based at this depth; and the break in slope from the continental shelf occurs at about 75 to 85 metres. Radiocarbon dates in the latter depth range are 13,000 to 18,000 BP. Off the North Carolina coast the shelf break occurs at 65 to 75 metres; and a fossil reef tract, dated at 19,000 BP, lies at depths of 80 to 120 metres. Each continental margin region thus possesses two features of Wisconsin age which may be interpreted as ancient shorelines. On the other hand, off Barbados only one such feature is observed—a submerged reef tract at 67 to 74 metres. The few data available are thus consistent with the Matthews model.

Because the shoreline evidence is not sufficient to be fully convincing, Matthews goes on to suggest other consequences of his hypothesis which could be tested. An isostatic rise of the ocean basin will lead to upward movement of mantle material beneath the oceans. This implies reduced pressure in the upper mantle, the possibility of phase changes and the production of magma. But an increased water volume accompanying continental deglaciation will be insufficient to reverse these processes. On this model, accumulation of magma will lead to volcanism which should therefore correlate with glaciation periods and the occurrence of ancient shoreline features. The burden of the test will be to carry out much more radiometric dating of younger volcanics to define statistically significant periodicities in volcanism. It will be a long haul.

HIGH ENERGY PHYSICS

Setting the Scene

from our own Correspondent

THE outstanding problems of high energy physics were reviewed by Professor R. H. Dalitz of the University of Oxford in the Bakerian Lecture at the Royal Society on June 12. The discovery of a large number of baryon and meson resonance states has been the most significant feat of the past few years, he said, although the recent success of "duality" in linking high and intermediate energy regions of elementary particles must be considered among the most encouraging theoretical advances for some time. Some of the more fundamental experimental questions, such as the existence of the W boson or the fractionally charged quarks, are unlikely to be broached seriously, Professor Dalitz thought, until the latest accelerators have been completed.

Progress in understanding the weak interaction hinges on two points. Can a particle be found—a W boson—which would mediate the interaction in the same way as a photon mediates the electromagnetic interaction, and can a meaning be assigned to the vector currents that are associated with the weak