regions of potential gradient set up as water containing charged particles moves through the Earth's magnetic field. The rate of deposition will clearly depend on the velocity and direction of the current. We consider, therefore, that the enhanced deposition of manganese in this part of the Caribbean during glacial periods is probably due to enhanced water movements related somewhat irregularly to glaciation. The most reasonable type of movement would presumably be the spilling of cold water over the rim of the Caribbean basin. Non-steady state movements of this type are becoming recognized[3] as features of deep water circulation in various parts of the Atlantic. If our hypothesis proves reasonable, variation in manganese content in deep water sediments should throw considerable light on the incidence of such movements throughout the Pleistocene and possibly during more remote periods of the history of the ocean.

We are indebted to Prof. Maurice Ewing and to Dr. David B. Ericson of the Lamont Laboratory, Columbia University, and to Dr. Cesare Emiliani of the Marine Laboratory, University of Miami, for the opportunity to study this material. The work was supported by contract from the Office of Naval Research. A detailed report on the analyses will be published by one of us (P. J. W.) later.

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Grain Boundaries and Electroluminescence in Gallium Phosphide

SOME interesting properties of gallium phosphide have been studied in polycrystalline specimens kindly provided by H. Welker, of Seimens Schuckertwerke, Erlangen. Etching of the surface has revealed grain boundaries, and annealing twins. Etch pits have also been observed along slip lines.

Electroluminescence has been reported previously[1], but that observed here shows unusual features, in that the light sources form a pattern of narrow lines and are identifiable with grain boundaries. Most sources are found in the surface, though sheets of light have been observed, joining more intense sources in opposite faces. Not all boundaries luminesce, and on reversal of the current the light pattern changes markedly. Voltage probing shows that a large and constant proportion of the total applied voltage is developed across the luminescent boundary. Electroluminescence is also observed at a cathode point contact to the p-type gallium phosphide, indicating that minority carrier injection and radiative recombination occurs. It is proposed that this is the mechanism responsible for the grain boundary luminescence, and that impurity segregation at the boundary creates an n-layer between the p-type grains. This forms a p–n–p junction, or two p–n junctions 'back-to-back', and minority carrier injection and consequent radiative recombination occurs at whichever is the forward-biased junction. A junction of this sort in the grain boundary would

account for the observed voltage distribution, and the results of current-voltage studies are in agreement with the theories of Shockley and Prim[2] and Dacey[3] for p–n–p structures.

The observation of etch pits along slip lines indicates the possibility that these pits are formed at the points of emergence of dislocations, which would be of considerable interest. Further, if impurities at grain boundaries are responsible for electroluminescence, this phenomenon may prove a useful tool by which to study impurity atmospheres during boundary migration.

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Reaction of Carbon Monoxide with Graphitic Carbon at 450° C.

PUBLISHED investigations of researches on the reaction of carbon monoxide with carbonaceous solids have been concerned with the Boudouard reaction, $2CO \rightleftharpoons C + CO_2$. Many measurements have been reported above 500° C. in which range the rate of reaction is appreciable and the resultant partial pressure of carbon dioxide is measurable. Below 500° C. the observed partial pressure of carbon dioxide is so low that it cannot be differentiated experimentally from that normally expected on outgassing such materials, although the equilibrium values for the carbon dioxide are higher than those above 500° C.

Experimental conditions have now been discovered whereby an appreciable reaction occurs between carbon monoxide and some graphites at 450° C. However, carbon dioxide is not formed. The sample was contained in a 'Vycor' tube through which purified carbon monoxide was circulated. Traces of water vapour were continuously removed by liquid nitrogen traps on both sides of the sample tube. When necessary each sample was previously treated with hydrochloric and hydrofluoric acids to assure the absence of metallic impurities as evidenced by spectrochemical analyses. It was then heated for 20–40 hr. with evacuation at either 450° or 700° C. and then cooled in the latter case to 450° C. before the introduction of carbon monoxide. A definite chemisorption of the carbon monoxide was observed. A more significant result was the formation of a carbon deposit downstream at locations well beyond the bed of graphite. Mass-spectroscopic analyses proved the almost complete absence of gases other than carbon monoxide even after the liquid nitrogen was removed. A chemical analysis of the deposit demonstrated it to consist of carbon.

The following mechanism could account for these observations. The first step is the chemisorption of a carbon monoxide molecule. A second carbon monoxide molecule is then chemisorbed to the chemisorption complex, which then reacts to form gaseous carbon suboxide, C_3O_2. This serves to transport the carbon atoms of the graphite through