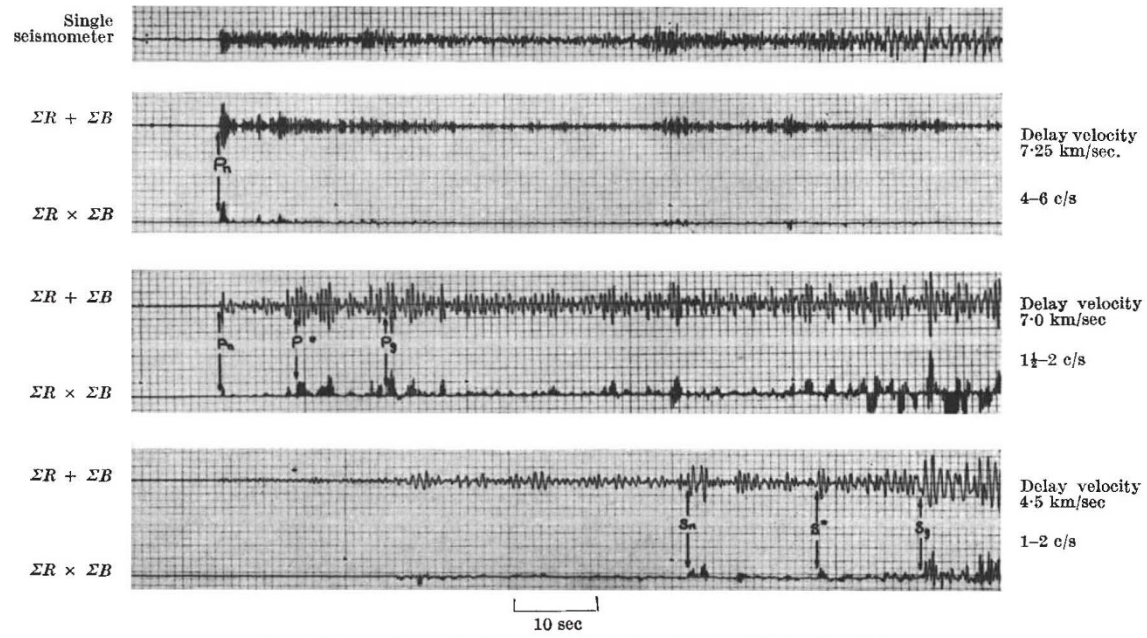

Fig. 2. Processed records of the South Downs earthquake, October 25, 1963

for such investigations and have access to U.K. Atomic Energy Authority's facilities. In the meantime, a limited number of copies of the records can be made available for more detailed study.

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PHYSICS

Cathode Glow (Erste Kathodenschicht) Spectra and Surface Neutralization of Ions

The spectrum of the light from close to the cathode surface in a cold cathode discharge in nitrogen, at the negative end of the positive space charge of the cathode dark space, is remarkable for consisting predominantly of arc lines of nitrogen (N I)[1,2]. These lines are normally far less prominent elsewhere, for example, in the negative glow and positive column. As there is some evidence[1] for a similar development of arc lines in a number of other common molecular gases, we have also made a survey of cathode glow spectra in some less frequently used vapours.

The materials studied fall into two classes. The first consists of two substances like nitrogen chemically, phosphorus and arsenic. The second consists of two chemically different substances, selenium and iodine. Each required special techniques for handling. Sulphur, for which it would also be interesting to have data, has so far proved unmanageable. The tubes used were developments of the spiral cathode types used by Emeleus and Hall[1], giving the equivalent of an end-on capillary cathode glow source. The pressures used were usually less than 1 mm mercury.

In each instance we have found that there is the same preferential development of spectra of the neutral atom in the cathode glow that there is with nitrogen. Since it occurs with both classes of elements, it cannot be due to a specific property of nitrogen-like elements, and it is probably a common property of all molecular gases.

The cathode glow is difficult to investigate by other than optical methods, and little is known even yet about the relative extent to which its properties are due to electrons originating at the cathode and positive ions moving initially in the opposite direction, particularly in molecular gases. If the local build-up of excited atoms is connected with dissociative neutralization of molecular ions on the cathode surface[2], the fragments may have initial speeds away from the cathode much greater than thermal, like 'retrograde' rays[3].

The present communication may be of some general interest in indicating that the composition of a dissociating molecular gas, in particular the concentration of excited atoms, may be markedly different near a boundary where neutralization of ions is occurring, and in the body of a discharge.

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A Deduction of Carathéodory's Principle from Kelvin's Principle

This communication gives a simple deduction of Carathéodory's principle from Kelvin's principle that it is impossible to convert an amount of heat completely into work in a cyclic process without at the same time producing other changes. There has always been some difficulty in motivating Carathéodory's principle convincingly[1]. The present argument demonstrates for the first time that this principle can be obtained directly and simply from the impossibility of a perpetuum mobile of the second kind, and some reappraisal of the relationship between these two methods of developing thermodynamics appears, therefore, to be required.

Equilibrium states are represented in a thermodynamic phase space. Suppose this space contains a point A which possesses a neighbourhood N, all points of which can be