

In studying the European records of the 1929 Buller (N.Z.) earthquake, I have found unmistakable signs of  $S'_1$  at 16 stations between  $145^\circ$  and  $175^\circ$  from the epicentre. At Abisco ( $149.9^\circ$ ) and Pulkovo ( $150.6^\circ$ ), large amplitudes appear. Later, before  $156^\circ$ , signs of the second branch emerge, and reach prominence at Vienna ( $162.0^\circ$ ). This movement has been traced at 19 stations within  $180^\circ$ , and at 7 stations beyond. In most cases, the phase closely following,  $PPS$ , is also distinguishable and a separate curve has been plotted for it.

The travel-times for the shear waves agree with Gutenberg's predictions to within 10 seconds throughout most of the range; and point undoubtedly to the possibility of these waves having arrived at the antipodes by way of the core. Comparing these times for the two branches with the corresponding travel-times for the two branches of  $P'$ , we obtain ratios, for  $165^\circ$ , of 1.80 and 1.81, which agree remarkably well with the values for the velocity ratio (1.79-1.84) for  $P$  and  $S$  waves which have travelled wholly through the extra-nuclear layer. The rigidity of the core thus seems to be definitely established.

It seems appropriate at this juncture to revise the notation for these phases. Recently the Seismological Committee of the British Association has approved of the use of  $K$  instead of  $cP_c$  for compressional waves through the core; and 'SKS' has thus received official sanction.  $P'$  might similarly be written  $PKP$ . The objection to the dashed notation is that it has received wide support to indicate phases registered beyond  $180^\circ$ . The desirability of using it in this connexion for the shear waves beyond the antipodes emerges from what has been said above. In order to maintain a uniform notation, it is now suggested to employ  $Z$  for shear waves through the core; so that  $S'_1$  becomes  $SZS$ ; and a square bracket or other similar device would indicate the later branch of each movement. Thus  $P'_2 = [PKP]$ ,  $S'_2 = [SZS]$  within  $180^\circ$  and  $[SZS]'$  beyond.

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<sup>1</sup> Ueber Erdbebenwellen VIIA. *Nachr. Ges. Wiss. Gott.*, 125; 1914.

<sup>2</sup> *Gerlands Bei. Geophys.*, 28, 165; 1930.

<sup>3</sup> *Proc. Imp. Acad. Tokyo*, 8, 354; 1932.

### Structure of the Nitro Group

THE usual formula given to the nitro group is  $-N \begin{smallmatrix} =O \\ \searrow \\ O \end{smallmatrix}$ , containing a co-ordinate link<sup>1</sup>, and it is supported by the parachor evidence<sup>2</sup>. On account of this dissymmetry, both the compounds 1.4-dinitrobenzene and 1.3.5-trinitrobenzene should possess finite electric dipole moments. Also studies in benzene<sup>3</sup> and in naphthalene<sup>4</sup> have resulted in moments of 0.6 and 0.8 Debye units being ascribed to the di- and tri-substituted compounds respectively.

The electric moment  $\mu$  is calculated from  $\infty P_2 - EP_2 = 4\pi N\mu^2/9kT$  with the usual notation, the differences  $\infty P_2 - EP_2$  having been found to be finite in the solvents used, and in the case of trinitrobenzene in benzene amounting to 14 c.c. The problem we have is correctly to assign these finite differences. There are three possibilities:

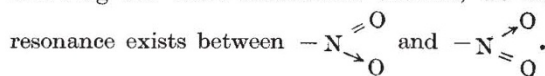
(1) The molecules have permanent electric moments.

(2) The differences  $\infty P_2 - EP_2$  are real, but are to be ascribed to atom polarisation, this being the opinion of Smyth<sup>5</sup>.

(3) The last possibility, which it is hoped has now been proved, is that the differences are spurious, being due to specific solvent effects of benzene and naphthalene on the dissolved nitro bodies.

Now compounds of benzene and naphthalene with these nitro bodies are known<sup>4,6</sup>, and if they exist in solution the usual dipole procedure will become upset, and the results will be of doubtful significance. That this has occurred has now been shown by measuring  $\infty P_2 - EP_2$  for both 1.4-dinitrobenzene and 1.3.5-trinitrobenzene in the polar solvent chloroform, and in each case a zero value was obtained. The suitability of chloroform as a solvent for measuring the dipole moments of non-polar molecules was demonstrated by showing that  $\infty P_2 - EP_2$  was zero for benzene in chloroform.

Evidently, then, both the nitro compounds are non-polar, the nitro group is symmetrical, and so, following the wave mechanical chemist, we say a



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<sup>1</sup> Sidgwick, "Electronic Theory of Valency", p. 65.

<sup>2</sup> Sugden, "The Parachor and Valency", p. 118.

<sup>3</sup> Parts, *Z. Phys. Chem.*, 4 B, 227; 1929. Tiganik, *ibid.*, 13 B, 425; 1931. Lutgert, *ibid.*, 14 B, 31; 1931.

<sup>4</sup> Briegleb and Kambeitz, *Naturwiss.*, 105; 1934.

<sup>5</sup> "Dielectric Constant and Molecular Structure".

<sup>6</sup> D. I. Hammick, Hills and Howard, *J. Chem. Soc.*, 1530; 1932.

### Synthesis in the Œstrin Group

THE chemistry of  $\alpha$ -folliculin ( $\alpha$ -œstrone) is now fairly well understood, through the combined researches of the British and the German schools. It will no doubt be highly interesting to institute a series of synthetical investigations in this group of substances. Work in this direction has been in progress in this laboratory for some time past, and the opportunity is taken to place on record a brief outline of the method that is being pursued.

In the first instance,  $\beta$ -1-naphthylethyl bromide was condensed with the sodio-derivative of methyl  $\beta$ -keto adipate (b.p.  $127-128^\circ/4$  mm.), which was prepared in quantity by the usual methods. The resulting ketoester smoothly underwent phenanthrene cyclisation in presence of sulphuric acid giving 2-carboxy-3:4-dihydrophenanthrene-1-propionic acid (m.p.  $226-227^\circ$ , once crystallised). The latter on distillation with acetic anhydride gave a beautifully crystalline substance (m.p.  $210^\circ$ ) having the composition  $C_{17}H_{14}O$ . The œstrus-producing activity of the final product, which is being studied, is likely to yield interesting results. Further work along this line, starting from initial materials containing appropriate substituents, are actively in progress with the view of synthesising  $\alpha$ -œstrone and other related ketones.

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