atoms; we must, however, before closing, refer to the practical utility of their discovery which Curie and Joliot have pointed out.[12] The new artificially produced radioactive elements and their radiations may in the near future displace the costly radium for therapeutic purposes, and minute traces of these radioactive bodies may be utilised as indicators in studying biological processes. Both of these happy ideas promise to produce lasting good to humanity and we may be confident that the important discoveries of Curie and Joliot will be followed up and lead to advances of vital importance in times shortly to come.

Baluchistan Earthquake of May 31, 1935.

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BARELY seventeen months have passed since the occurrence of the disastrous earthquake in Bihar and Nepal, and India is again sorely stricken by another calamitous earthquake in Baluchistan. The present note gives such preliminary information regarding the focal region and the intensity of the Baluchistan earthquake as can be gathered from the records of the Colaba Observatory alone.

Colaba Milne-Shaw seismograms of the Baluchistan earthquake are reproduced in Fig. 1 (N-S component) and Fig. 2 (E-W component). The preliminary and the

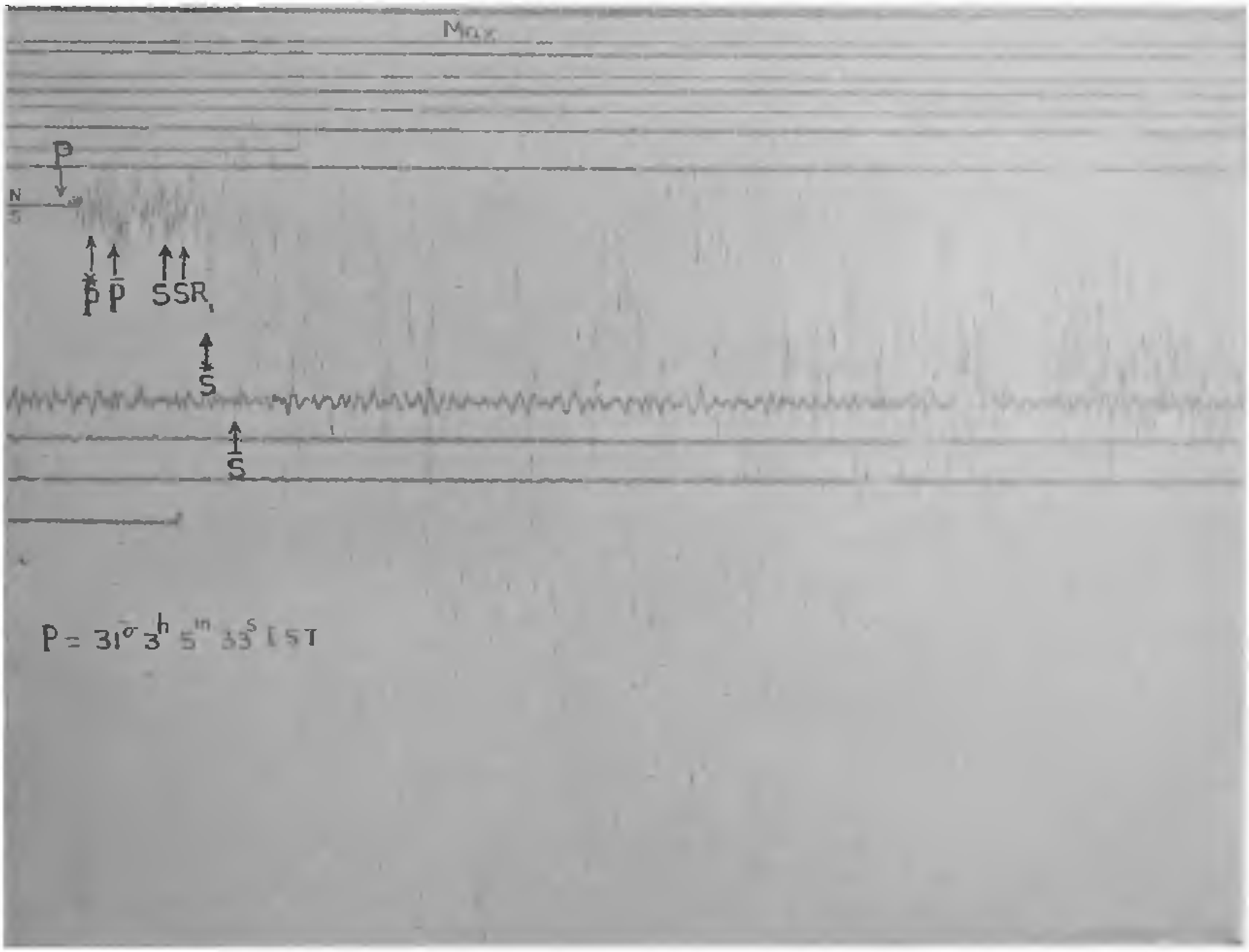

Fig. 1.

Colaba Seismogram of Baluchistan Earthquake, May 31, 1935. Milne-Shaw North-South.

[12] *Radioactivité Artificielle*, Hermann et Cie, Paris, 1935.

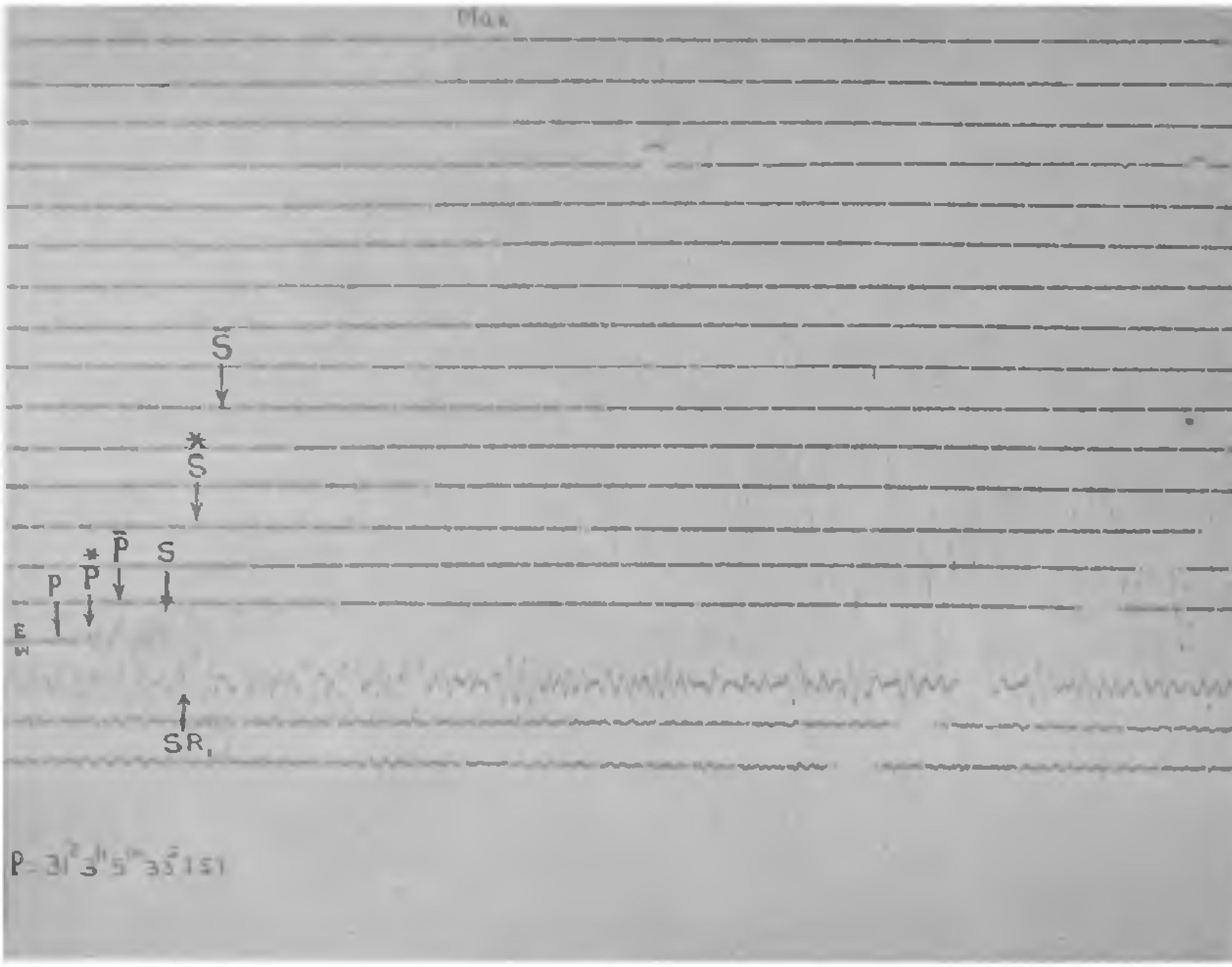

Fig. 2.

Colaba Seismogram of Baluchistan Earthquake, May 31, 1935. Milne-Shaw East-West.

secondary waves of shocks originating in the upper layer or crust of the earth travel to a near station in three distinct paths. The six phases P, $\overset{*}{P}$, $\overline{P}$, S, $\overset{*}{S}$ and $\overline{S}$ appear to be identifiable on the Colaba seismograms of the Baluchistan earthquake as in the case of the North Bihar earthquake.[1] The development of destructive surface waves also supports that the focal region of the Baluchistan shock was shallow in depth. An estimate of the actual depth can be made only when it is possible to scrutinise and study the records from other Indian seismic stations. The S-P interval at Colaba is 2 mts. 21 secs. giving an epicentral distance of about 1300 kms. The first preliminary tremors begin with an impetus of 5·2 μ towards south and 2·3 μ towards east giving the direction of the focal region as 333°. These data would locate the focal region of the earthquake roughly about 40 kilometers to the south of Quetta. The origin time of the shock is calculated to be 3 hrs. 2 mts. 43 secs. I.S.T.

An estimate of the energy of the Baluchistan earthquake can be made from the Colaba seismic records by using a formula given by Dr. Harold Jeffreys.[2] While calculating the energy of the Pamir Earthquake of February 18, 1911, Dr. Jeffreys has shown that the major part of the energy of an earthquake is carried by the Rayleigh waves, the contribution from the longitudinal and the distortional waves being only a few per cent. of the contribution by the long waves. Energy in a Rayleigh wave is the same as if there were no vertical motion and the horizontal motion had the same amplitude as at the surface down to a depth $H = 1 \cdot 12\ \lambda$, where λ is the wave-length. The total energy crossing a small circle at distance Δ from the origin is

$$E = 8\pi^3 R \sin\Delta\, \rho \int \frac{a^2\, HV}{T^2}\, dt$$

[1] *Curr. Sci.*, May 1934, 2, 419; and Jan. 1935, 3, 298.

[2] *M. N. Geo.-Suppl.*, January 1929, 1, 22–31.

where R = Radius of the earth.
Δ = Epicentral distance in degrees of arc.
ρ = Density of the earth's crust.
α = Amplitude of the earth's horizontal motion.
T = Period of the long wave.
and V = Velocity of propagation of long waves.

Now taking

$R = 6 \cdot 4 \times 10^8$ cms. ; $\rho = 3 \cdot 0$ gm./cm.^{3}

and $V = 3 \cdot 0 \times 10^5$ cm./sec.

we have

$$E = 4 \cdot 3 \times 10^{17} \sin\Delta \times \int \frac{\alpha^2 H}{T^2} dt.$$

The average value of T at Colaba for the Baluchistan earthquake is about 12 s. and taking the average velocity of long waves as 3 km./sec. we find that $H = 4 \times 10^6$ cms. Also from the seismograms the value of $\int \frac{\alpha^2 dt}{T^2}$ is $0 \cdot 02$ cm.^{2}/sec. The energy of the Baluchistan earthquake thus works out to be about 7×10^{21} ergs. The Colaba records of the North Bihar earthquake of January 15, 1934, were not satisfactory but a rough estimate for that shock gives the value of $\int \frac{\alpha^2 dt}{T^2}$ near about $0 \cdot 2$ cm^2./sec., leading to the approximate value of 7×10^{22} ergs for its energy. Bihar earthquake was therefore about 10 times more energetic than the Baluchistan earthquake. This conclusion is also supported by the fact that the maximum amplitude of earth's motion at Colaba was greater than 1300 μ in the case of the Bihar earthquake while it is only about 400 μ for the Baluchistan shock. But the most unfortunate thing about the Baluchistan earthquake has been its occurrence during the early hours of the morning with consequent heavy death-roll.

The Progress of Work in India on the Embryology of Angiosperms.

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INVESTIGATIONS on this subject started in this country only about fifteen years ago, but the number of annual contributions since then has been steadily increasing. The purpose of this article is to give a brief review of this work and to consider, if possible, some of the lines of research that may be most profitably undertaken in future by students of embryology in this country. Some judgment has been exercised in the selection of papers and a few investigations dealing with purely cytological studies have been left out, but otherwise the review is complete, and as far as the writer is aware, no important papers have been omitted.

The first observations of this kind were published from Allahabad by Kenoyer[1] (1919) who, while describing the dimorphic carpellate flowers in *Acalypha indica* L., noted the obturator, the beak-like tip of the nucellus and a few stages in the development of the embryo sac, which were, however, quite insufficient to permit definite conclusions.

Dastur[2] (1922) in an investigation of *Hydnora africana* Thumb., an interesting parasite, material of which had been collected from South Africa, writes that the ovules are orthotropous and have a single integument. The megaspore mother cell is hypodermal and directly gives rise to an 8-nucleate embryo sac of the Lilium-type. The most noteworthy fact is that the proembryo consists of a long chain of cells, of which the middle region gives rise to the embryo proper. These observations are of great interest, but it must be pointed out that the material was probably insufficient for a critical investigation and, as Schnarf[24] (1931) has pointed out, the statements need confirmation.

Tiwary[3] (1926), from Benares, made the *interesting discovery of polyembryony in Eugenia jambolana*, the extra embryos arising from the position of the egg apparatus or from the nucellus. It is also stated the original embryo sac sometimes becomes pressed out and obliterated, while some of the nucellar cells appear to be on their way to form embryo sacs. It may be mentioned here that recently Pijl[23] (1934) has published the results of a detailed study of polyembryony in several spp. of *Eugenia* and his observations differ in some respects from those of Tiwary.

Tiwary and Rao[4] (1934) have traced the development of the embryo sac in another member of the Myrtaceæ, ***Callistemon linearis***,