and 30 p.p.m., respectively while zinc could not be estimated below 100 p.p.m., though their detection limits are much lower, namely, 1-2, 20 and 50 p.p.m. respectively. Recoveries of these elements added to the synthetic soil of the composition SiO_2 61·0%, Al_2O_3 19·4%, Fe_2O_3 4·8%, Na_2CO_3 3·4%, K_2CO_3 2·7%, CaO 1·9%, $MgSO_4$ 5·8%, TiO_2 1·0%, are given in Table I. Average of duplicates usually closely agreeing were taken. The wave-length of the lines used are given in brackets.

TABLE I

Recovery of micro-elements added to synthetic soil

Micro-elements	Internal Standard	Content of Manganese in p.p.m.	
		added	recovered
B (2497·7 Å)	Bi (2898·0 Å)	223	228
		46	45
Mn (2794·8 Å)	Bi (2898·0 Å)	208	210
		66	70
Zn (3345·0 Å)	Cd (3403·6 Å)	208	220

Manganese status of different samples of soil as estimated by this method is compared with the values obtained using chemical method in Table II. Values recorded are results of single determinations.

TABLE II

Manganese content in soil samples as estimated by spectrographic and chemical methods

Soil sample No.	Content of Mn in p.p.m. obtained by	
	Spectrographic method	Chemical method*
1	1480	1360
2	1320	1200
3	950	860
4	750	720
5	925	870
6	560	609
7	607	642

* The first five values were worked out by Shri O. P. Dhameja and the last two by Shri R. K. Chatterji and Dr. N. R. Datta Biswas.

The results recorded indicate that within 10% variation there is agreement between the spectrographic and chemical methods of estimation. In most of the Indian soils, as the manganese and boron contents are much higher than the lower limits of estimation, the copper arc method developed is being used as a rapid routine method of analysis in this laboratory. Zinc could be detected in soils only at a level of 300 p.p.m. using the cathode layer arc technique while the anode excitation method[3] made the detection possible at a level of 50 p.p.m. The results recorded in the present investigation compare very favourably with those obtained by anode excitation. Further work on the possibility of using this technique for the estimation of other elements is in progress.

The authors record their grateful thanks to Dr. B. P. Pal and to Dr. S. P. Raychaudhuri for their interest in the progress of the work.

Indian Agric. Res. Inst., New Delhi,
S. C. MEHTA.
C. DAKSHINAMURTI.
October 22, 1955.

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V-SHAPED STRUCTURES IN THE JHIRI SHALES*

THE Jhiri shales of the Rewa series together with the other beds of the Vindhyan System in Bundelkhand are practically horizontally bedded sediments. They are devoid of any more complex structural features, even gentle folds or steep dips being altogether absent. However, in the open-cast pits of the Shahidan diamond mine near Panna in Vindhya Pradesh some peculiar V-shaped structures are seen in these shales. These are confined to

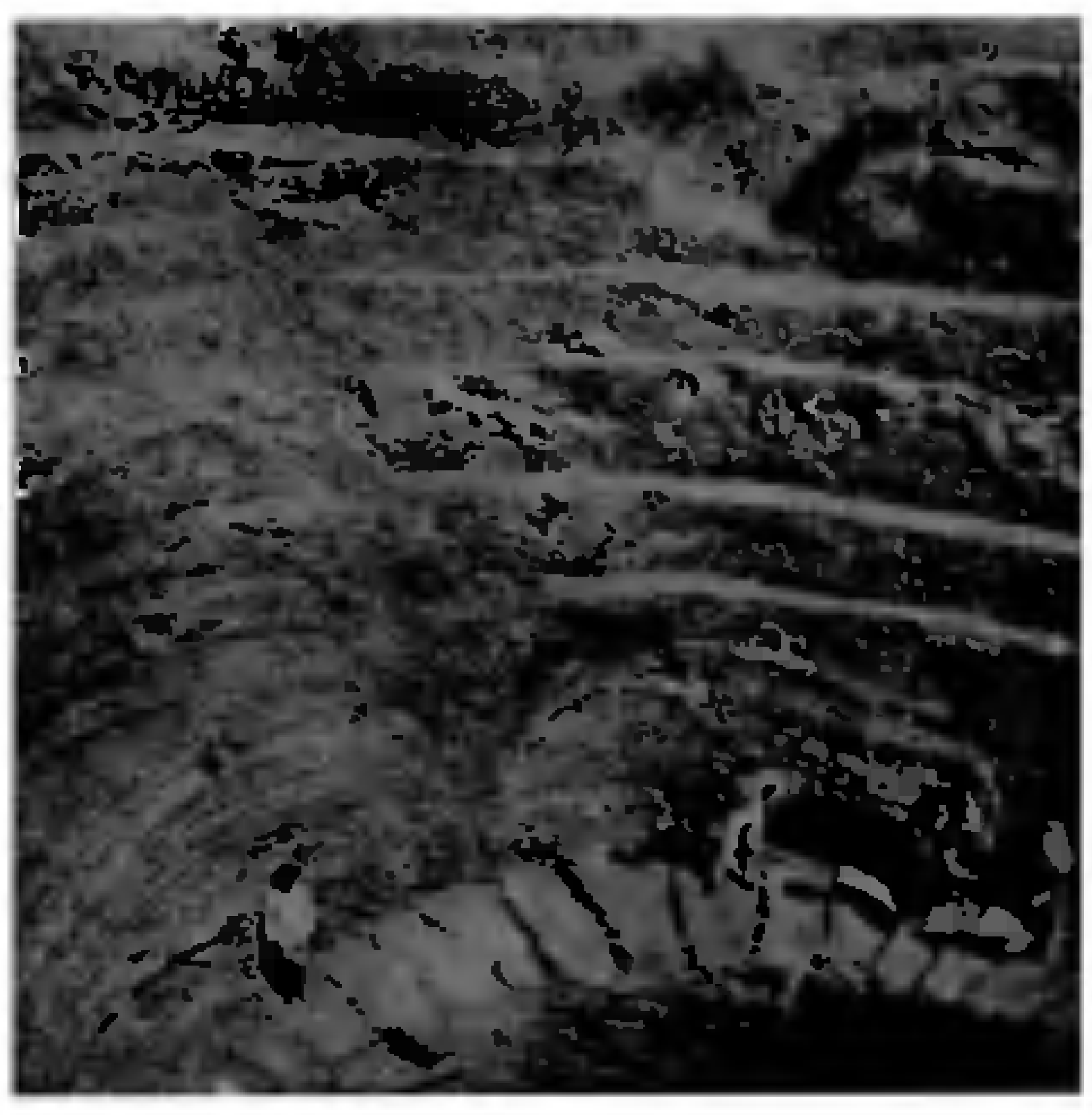

FIG. 1. V-shaped structure seen in the Jhiri shales exposed in a pit in the Shahidan diamond mine, Panna. The apparent curving of the beds where the men are standing is due to the circular wall of the pit.

the top layers of the formation and go down only a few feet from the surface. From a casual glance they appear like vertical isoclinal synclines (Fig. 1), but a close inspection reveals that they are not folds but are actually wedge-shaped vertical depressions or cracks in the otherwise horizontal sediments. In transverse section (Fig. 2) it is seen that the shale

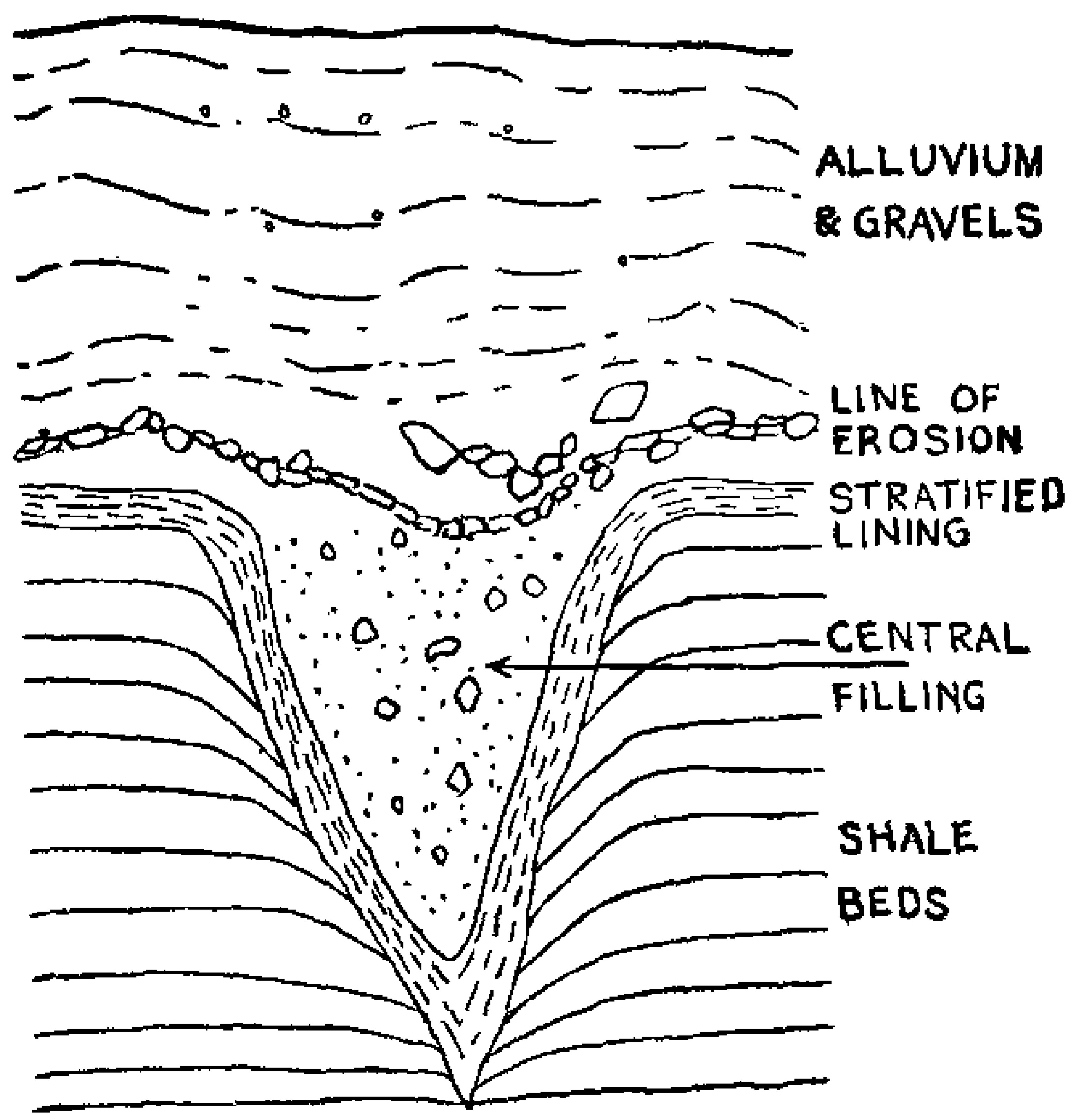

FIG. 2. Diagrammatic sketch of a cross-section of the fully developed crack shown in Fig. 1. It shows the horizontal shale turning slightly downwards adjacent to the crack, stratified lining layer, and unstratified central filling of alluvium, gravel and rock boulders.

laminæ tend to turn slightly downwards adjacent to the depression, which has a stratified lining that appears to be the folded portion of the topmost shale layers and gives the impression of a syncline. This lining is generally less than a foot in thickness, while the depression is generally 10 to 12′ deep but sometimes much less. The top of the structure is 5 to 8′ wide, and the depression is filled with unstratified alluvium, gravel and boulders. The soil mantling this formation is also somewhat stratified and gently undulating.

Paterson[1] and Leffingwell[2] have studied similar structures which they ascribe to *frost action* in Arctic climate. The same mechanism probably has also given rise to these cracks in the Jhiri Shales. They do not appear to be folds formed by moving ice as suggested by Ahmad.[3] They are also unlike similar cracks formed by desiccation in hot climates, which, according to Smith,[4] are narrow in proportion to depth and the wall rocks do not show any marginal distortion.

I am thankful to my colleague Mr. B. N. Raina with whom I have profitably discussed this note.

Northern Circle, S. M. MATHUR.
Geological Survey of India,
Lucknow, *August* 18, 1955.

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* Published by permission of the Director, *Geological Survey of India.*

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ORIGIN OF INDIALITE (CORDIERITE) BEARING AND OTHER VITROPHYRIC AND HORNFELSIC ROCKS

A. MIYASHIRO AND T. IIYAMA[1] have discovered a new hexagonal mineral in the "fused sediments (so-called para-lava)" of Bokaro Coalfield, India $(Mg\ Fe^{++})_2\ Al_4Si_5O_{18}$ in composition polymorphic with cordierite. This mineral has been identified hitherto as cordierite, but the X-ray analyses led them to identify it as a new mineral and they have proposed the name "indialite" to it. Similar indialite-bearing vitrophyric and hornfelsic rocks have been observed at the contact of mica-lamprophyre intrusions by the authors of this note at many localities in the Jharia and Raniganj Coalfields, but two localities have been particularly chosen, one along the XIV seam, Chasnala Colliery, Jharia Coalfield and another along the Ramnagar seam, Victoria West Colliery, Raniganj Coalfield, because the geological setting of these vitrophyric and hornfelsic rocks are interesting from the point of origin.

At Chasnala area the indialite-bearing and plagioclase-bearing vitrophyric and hornfelsic rocks are closely associated with the burnt shale due to recent outcrop coalfire and occur adjacent to a mica-lamprophyre sill. In the Victoria West Colliery, the indialite-bearing vitrophyric and hornfelsic rocks occur as xenoliths in the mica-lamprophyre (peridotite) sill at the 14th level (684·75′ below surface level). The watertable in this mine occurs below a depth of 50′ from the surface. In these vitrophyric and hornfelsic rocks, indialite is often associated with sillimanite, tridymite and spinel. The form, twinning and optical properties of this mineral have been described in detail by Venkatesh[2] and P. R. J. Naidu[3] who have termed this mineral as cordierite. In a preliminary