

splitplot designs, is logically one more step and the significance of different errors—*e.g.*, errors A and B—in the case of a split-plot design have been explained; it seems necessary to point out that the split-plot design cannot be used when all comparisons are wanted with *equal precision*.

The principle of 'covariance' so clearly explained in pages 45–56, is indeed a very powerful tool at the hands of the experimenter to clear many complicated points arising in the interpretation of data involving simultaneous variations. The method is particularly useful in correcting a set of data on the basis of preliminary observations, such as for example, yield of one year on the basis of yield of the previous year or years in the same set of plots; or again the yield may be corrected on the basis of plant or number. Similar to the usual analysis of variance, the table of analysis of covariance is constructed. It would be possible from such a table to know the correlations of

'within groups' or 'error', from which significant relationship or otherwise between the two sets of observations could be judged. The 'corrected' experimental yields are then worked out, which would form the correct basis for drawing inference. At Cambridge it has now become the habit to work out 'covariance' on all preliminary observations, and calculate  $r$  and  $b$ ; if these are insignificant a further procedure becomes useless.

#### CONCLUSION.

The authors have thus covered practically almost the whole ground useful to the agricultural experimenter (except the principle of 'confounding' which is now being applied in a large measure to factorial designs), and have elucidated many points of interest. But it should be said that research suitable to our own conditions should be carried out to evolve our own standards in the matter of field technique.

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### Ancient Schistose Formations of Peninsular India\*

THE most recent geological map of India appeared in 1931. No description of the geology of the country was published with the map; Sir Edwin Pascoe is now engaged in compiling such a description and this will appear at an early date as a *Manual of the Geology of India*. Some sixty per cent. of the area of the Peninsula is occupied by crystalline rocks and it is to be expected, perhaps, that these should receive a more detailed treatment than can be incorporated in a manual. It is such a treatment that Sir Lewis now contemplates.

There are two methods of attempting such a comprehensive work. One method is to write the whole and revise it immediately before submitting it to the Press; unfortunately, if the result is to be satisfactory, revision may mean the complete rewriting of the whole—a case in point is

the *Geology of Australia* written by Sir Edgeworth David and revised so thoroughly that it had not reached the Press up to the time of Sir Edgeworth's lamentable death in 1934. The other method is to publish it piecemeal as the parts are written, with a final appendix in which may be summarised all that new material which accumulated during the successive appearance of the different parts. Presumably Sir Lewis intends to follow the latter plan.

The investigation of metamorphic rocks is a specialist's life study. Sir Lewis is such a specialist and his 17 years of field work included in 33 years of service in India renders him amongst those fitted to undertake such a work. Many geologists would prefer to see each section in a treatise of this nature from the pen of the authority or authorities in each particular area. Sir Lewis's plan of writing the whole himself at least eliminates the possibility of that acrimonious discussion which is so likely to appear from the clashing of the diverse views of authorities.

Those of us who have worked on metamorphic rocks and have also visited areas of metamorphic rocks in other countries will appreciate something of the task which

\* "An attempt at the correlation of the ancient schistose formations of Peninsular India," by Sir Lewis Fermor, *Memoirs of the Geological Survey of India*, 1936, 70, Part I, 51 pp. With one map.

Note: The memoir, part I of which is the subject of this review, is a comprehensive discussion on the Archæan rocks of India from the pen of Sir Lewis Fermor; the remaining parts are to appear from time to time during, it is hoped, the next few years.

Sir Lewis has set himself for India. In this country we have had detailed mapping in widely separated areas, and attempts at correlation may be compared, perhaps, to attempts at correlating the rocks of the Lake Superior region with metamorphic rocks in the Alleghanies, the Black Hills and in the Rockies, or between Scotland, Scandinavia and Central Europe. Unfortunately we are too prone to think of a country as a geological entity, forgetting the vastness of a country like India and the great distances separating the mapped areas. Except in a few isolated regions the geological map of India gives but a crude sketch of the Archæan rocks.

Detailed mapping on careful modern lines has been in progress for little more than 20 years; Sir Lewis makes the illuminating remark that "Most of our memoirs on the geology of Southern India were written before the introduction of the microscopic study of rocks into India." However, in Rajputana Dr. Heron's record of nearly 30 years of continuous mapping has resulted in the only satisfactorily completed areal unit in India. In other parts of India most of the work has been in progress continuously since the War. In the Central Provinces Sir Lewis Fermor's party has done some fine detailed mapping over a comparatively small area. In Bihar and the adjacent Eastern States Agency a party, centred around Singhbhum, has covered a rather larger area in detail. Recently a survey party commenced work in Bastar State which should clear up some of the problems of the Charnockites and related rocks. Geological surveys in South India have gone on continuously, but no connected account has appeared in recent years. These facts will indicate the real paucity of connection between these isolated areas.

Sir Lewis recognises all the difficulties and clearly enumerates them. One turns these first pages with something of awe for this brave attempt—there will be much of reverence if, on its conclusion, Sir Lewis has unrolled before us a convincing picture of any detailed correlation which he may make.

Part I is introductory in nature, its principal object being to discuss the several factors which may be concerned in correlation and to divide the country into provinces of a size suitable for description. One

may note, at the commencement, that the memoir's title is not perhaps correct seeing that the author intends to describe rocks beyond the Peninsula—in Ceylon, Burma and the Himalayas.

On page 5, Sir Lewis re-quotes his definition of the term Archæan made in 1909; the arguments surrounding the use of the term *eparchæan unconformity* form nothing more nor less than a vicious circle. Cut down to the root of the matter the true definition is found on page 14—"I have taken the presence of either granitic or pegmatitic intrusives as sufficient reason for referring the rocks into which they are intruded to the Archæan rather than the Puranas."

In the excellent discussion of the well-known factors involved in correlation Sir Lewis brings up again the question of crush-conglomerates. I think, from their recent work, several Mysore geologists will demur at the statement: "In the Dharwar series of Mysore there are many conglomerates, but these are all regarded by the Mysore geologists as probably due to crush." Except in Sir Lewis's own area, Central Provinces, this mode of origin for sheared conglomerates seems to have died leaving no regrets.

Apparently the author intends to make some use of the manganese occurrences in correlation. This is dangerous ground of which, no doubt, he is well aware. In the Iron-ore series there is a manganiferous shale horizon near the base and another near the top. Similarly in the use of the iron-ore for the same purpose, although the Iron-ore series is the main source of iron-ores, the pebbles in the basal conglomerate indicate that iron-ores occurred in an older series.

There are several minor points with which some petrologists will not agree, such as metasomatism as an occasional factor in metamorphism, and the solvent action of water in metamorphism, but until we come to the discussion on charnockites there is nothing to cause serious disagreement from the point of view of the purpose of this memoir. Sir Lewis appears to have accepted Stillwell's view that the charnockites are metamorphic rocks of the hypo-zone. Many of us were of this view until recently, but some of us would now revert, in part, to Holland's original description of them as normal igneous rocks. May they not be

