

a result of the stresses set up by a concealed intrusion which denudation has not yet exposed to the surface.

In addition to these, a number of other laccolithic intrusions appear to lie on a line which runs from Baroda *via* Bhavangar and Girnar to the Barda hills. An assumed northerly shift of this line makes it continuous along the intrusions of Cutch, Baluchistan, and Persia. It indicates a zone of weakness which keeps its parallelism to the coast and along which the basaltic magma was still able to intrude itself when the ascensive force was unable to bring it any longer to the surface. Slow crystallisation at some depth in the local magma reservoirs brought about differentiation and resulted in the production of acid types which took a plutonic, hypabyssal, or volcanic phase according to the mechanical strength of the intruded beds and the movement of the magma. The acid igneous rocks of the Deccan Trap, therefore, appear to represent the end product of differentiation in a basaltic magma.

This period of laccolithic and dyke intrusions was followed by the manifestation of local volcanic activity of the explosive type at various centres probably on the top of cooling reservoirs. Detailed investigations have been carried out by us on the Pawagadh hill, near Baroda, the rhyolites of which were first described, after a hurried visit to this locality, by Dr. L. L. Fermor, who had suspected an interbedding of rhyolite with basalt. The results of our examination of the hill show that Pawagadh became a centre of volcanic activity of an explosive type long after the cessation of the eruption of plateau basalt, during which interval valleys had been carved out in the existing lava flows. Doleritic olivine-basalt was extravasated in contrast to the olivine-free compact plateau basalt, followed by andesitic lavas and tuffs. Rhyolite flowed at the end from a central neck at the top of the hill (2811 feet) and from a few other subsidiary vents at a lower level. The Osham hill, where the rhyolite occurs again as the end product, appears to have had a similar history. A number of other volcanic vents are known on the line of laccoliths indicated above. This association confirms the explanation of volcanic activity of the explosive type put forward by Dr. A. L. Day and supported by Prof. A. Holmes (*NATURE*, vol. 117, p. 66).

The above outline serves to indicate the fact that in Gujrat, Kathiawar and Cutch we have an interesting record of events of an igneous cycle initiated by a fissure eruption. Field and laboratory work is in progress which will throw light on the detailed history of this period.

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The State and Industrial Research Associations.

THE arguments adduced by Mr. J. W. Williamson in his paper on "The State and Industrial Research Associations," published in *NATURE* of Nov. 6, have made out several good reasons for the permanent subvention of such bodies by the State. No doubt his arguments might be met by the counter-argument that each industry should and could take out its own policy of insurance against ignorance.

Between these two alternatives there is a middle course which suggested itself to me in the course of past experience connected with the actual founding of one such association. This course would, I think, meet Mr. Williamson's views, and yet would still leave the responsibility for profitable development to be carried by the industry itself.

NO. 2978, VOL. 118]

The suggestion I would make is cognate with my analysis of research into eight classes, defined by the restriction or freedom of their methods, aims, and subjects respectively (*NATURE*, Aug. 28, 1926). In the second of these classes the research is restricted to a subject which may be of industrial importance, such as cotton, but it is otherwise free; not bound to any particular technique or science, not constrained to any aim, but working simply to increase the total of scientific knowledge concerning its subject, whether such knowledge be 'useless' or otherwise. Such research is a fit and proper subject for State endowment to a limited extent; indeed, it could probably make out a more forcible claim on social grounds than could pure science, my unrestricted first class.

In the organisation of such a research association as already exists, the endowment would support a nucleus organisation within it, whereto some three members of the staff would be allocated in such a way that even if an industry decided to abandon its association, the nucleus thereof would still continue to exist and function, upon a laboratory footing. Laboratories are not costly if they have not to concern themselves with the application of results; the administrative charges of such a nucleus would be trivial; the staff would, by definition, be picked men who could co-operate as colleagues without other formal direction than that of the accidental senior amongst them. They could be housed in some existing institution until such time as their industry saw fit to re-crystallise its research around this nucleus, in order to make their results usable by further studies made under restrictions of aim or method.

A State endowment of less than 4000*l.* a year would ensure such a nucleus of permanent appointments—not permanent staff—for each industry, and this nucleus would cost the same amount for every industry, large or small. The staff of an existing association would then be assured that, even if their association dissolved, still the roots of their work would continue to grow forward. Issues too big to be profitable could be taken up by this nucleus staff; issues too profitable to be interesting would be willingly met by temporary expansion of the industry's direct contribution, and the subsequent contraction would not involve a risk of disintegrating the whole structure.

A certain insecurity which is inherent in any organisation built entirely on voluntary levies has an unfavourable influence on research, and while I do not quite agree with Mr. Williamson's cogent plea for a permanent State support of research associations as at present constructed, I believe that the insertion therein of such permanent nuclei would sufficiently ensure all the aims he has expressed, and more.

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Modern Photometry.

ALTHOUGH, as the reviewer of Mr. J. W. T. Walsh's "Photometry" in *NATURE* of October 23 says, "The reader must not object to change" and "This is not the place to discuss fully the vexed question of nomenclature," and that "of course" Mr. Walsh uses the terminology adopted by the International Commission, I join in regretting the exchange of 'candle-power' for the words 'luminous intensity.' The official language of the Commission is French. Of course, 'candle-power' cannot be literally translated into French. I pointed out, at the meeting of the Commission in 1921, that M. Blondel at the Geneva Congress in 1896 had used the expression '*puissance lumineuse*,' but it was objected that the word '*puissance*'