



X-ray powder spectra of the reaction $\text{Al}_2\text{O}_3 + \text{MgO} \rightarrow \text{spinel}$.

	Per cent spinel.
(i) Alumina and magnesia	0
(ii) Alumina and magnesia, baked in air at 1,150° C.	20
(iii) Alumina and magnesia, baked in vacuum at 1,150° C.	65
(iv) Spinel	100

(set *a*), the spinel lines appeared stronger than in the corresponding air-baked ones (set *b*), this fact being perhaps most marked at a reaction temperature of 1,150° C. (see accompanying photograph). Photometer measurements on three lines of these specimens, using a 1 : 1 mixture of spinel and unreacted mixture as standard, showed about 65 per cent spinel in the (*a*) specimen and only about 20 per cent spinel in the air-baked one (*b*).

Using the relation between time and yield for powder reactions, these figures would indicate a more than ten-fold higher 'reaction constant' in the 'reduction' case. Neither the definition of the oxygen pressure and the powder size nor the accuracy of the analysis warrant more than the order of magnitude of this factor to be determined.

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¹ Wagner, C., *Z. phys. Chem.*, B, 25, 21 (1933); B, 34, 309 (1936). General Discussion on "Chemical Reactions Involving Solids". *Trans. Farad. Soc.*, 34, 822 (1938). Mott, N. F., *Trans. Farad. Soc.*, 36, 472 (1941).

² Hartmann, W., *Z. Phys.*, 102, 709 (1936).

³ Podszus, E., *Z. Elektrochem.*, 39, 78 (1933).

⁴ Mott, N. F., and Gurney, R. W., "Electronic Processes in Ionic Crystals" (Oxford: Clarendon Press, 1940).

⁵ Jander and Stamm, *Z. anorg. Chem.*, 199, 173 (1931).

wishes to reverse this result and to make the Persian Salt Eocene—but the reaction is not reversible. The Persian salt domes occur in an area which is unquestionably autochthonous and, as they intrude rocks of Middle Cretaceous age in some cases, the salt must be of that age or older. Some of the associated rocks brought up by the salt are of a saline facies, with salt pseudomorph sandstones, gypsum, etc., and the fossil control establishes Cambrian, therefore the presumptive evidence is that the salt is also Cambrian. The map accompanying J. V. Harrison's² paper shows the breadth of the normally folded zone and the impossibility of assuming any large-scale thrust faulting. Also the Cambrian, where it appears in normal exposure farther to the north-west, has a similar salty facies.

I have not had personal experience of the Salt Range, but from a study of the literature and from conversations with Gee, Lehner and others, I find that the regional evidence is strongly in favour of a Cambrian age for the Salt Marl group. If Sahni's further work establishes beyond all doubt that the land-plant remains really belong to the salt instead of being caught up by it perhaps during the forward thrusting, then the answer may be that there are two salts, one of Cambrian and one of Eocene age. This would be quite an acceptable solution, and its only unpleasant consequence would be that it would bring to an end what has been a very stimulating controversy. In Persia there are thick deposits of Miocene salt, lagunar conditions locally in Oligocene, Eocene, Cretaceous, Jurassic and Triassic, and there is also Cambrian Salt.

There has been a tendency in the past on the part of many geologists to disbelieve in the possibility of salt masses being as old as Cambrian and still preserved, and Sahni is in good company in this respect. I answered similar criticism from Krejci-Graf³ and Kosmat⁴ in 1938⁵. In this connexion, attention might be directed to the extensive Middle Cambrian Salt deposits of Siberia, and also to lagunar developments in Upper Cambrian, Silurian and Devonian⁶.

I hope to be able to send Sahni the samples from Persia for which he asks, and shall look forward to his further publication with great interest.

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¹ NATURE, 153, 462 (1944).

² Harrison, J. V., *Quart. J. Geol. Soc.*, 86, Pt. 4 (1930).

³ Krejci-Graf, *Centr. Min. Geol. und Cal.* (1927).

⁴ Kosmat, F., "Paläogeographie und Tektonik" (Berlin, 1936).

⁵ "Science of Petroleum", 142.

⁶ Vologdin, A. G., and Smirnov, L. P., *Inter. Geol. Congress Abstracts*, 25 (1937).

Age of the Saline Series in the Salt Range of the Punjab

In his attempt to establish as Eocene the age of the salt of the Salt Range of the Punjab, Prof. B. Sahni¹ has succumbed to the temptation of generalizing too far from a particular instance. In 1925 I discovered fossil evidence indicating a Cambrian age for the Hormuz Series of the Persian Gulf, and in consequence I became an advocate for a similar age for the Saline Series of the Salt Range. Sahni now

Prof. B. SAHNI¹ has anticipated me in publishing conclusive evidence regarding the non-Cambrian age of the Saline Series of the Punjab Salt Range.

In connexion with the researches at present being conducted in the Fuel Laboratories of the Imperial College, regarding the nature, composition and origin of kerogen rocks (oil shales and allied materials) of the world, I had the opportunity of examining in detail, during 1941-42, six specimens of kerogen rocks occurring in association with the Saline Series of the Punjab Salt Range and the salt