

The above formula does not represent all the bands which have been found, because there are certain striking perturbations in the vibrational levels of the upper state involved. The 3rd, 4th, and 5th vibrational levels of this state are shifted in the direction of higher energy by an approximately constant amount of about 4.5 cm.^{-1} (the measurements being accurate to within 1 cm.^{-1} or probably less). This is seen especially well in the ω -curve for the upper state, which is approximately linear, only the 2nd and 5th points lying far off it by about the same amount but in opposite directions. Similar perturbations have been found in an extended band system of P_2 ($\lambda 3500\text{-}2000 \text{ \AA.}$) which is also under investigation.¹ In this case these perturbations make the vibrational analysis very difficult because they occur both in the upper and in the lower state.

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¹ Part of this band system was discovered twenty-three years ago by Geuter (*Zeit. f. wiss. Phot.*, 5, 1, 1907).

Differentiation in the Dartmoor Granite.

IN his presidential address to the Devonshire Association on June 24, Mr. R. Hansford Worth devotes a section to a brief survey of Dartmoor geology and states, *inter alia*, that he cannot accept the idea of differentiated types of varied age for this granite mass.

As Mr. Worth points out, the granite as a whole is remarkably uniform in type, despite textural contrasts. But variants from the standard type are numerous, and their time-relationship to this type is often demonstrable.

Classified according to the C.I.P.W. system (based on detailed chemical analyses), these variants range from II. 4. (2)3. 3(4) to I. 4. 1. 2", with extreme types represented on one hand by highly biotitic vein-occurrences and, on the other, by considerable masses of quartz-felspar eutectic and pegmatite. The great bulk of the granite varies little from the type I. 4. 2. 3 which may be conveniently adopted as the standard. But the symbols for a suite of thirty granites representative of East Dartmoor, for example, reveal a graded and significant variation, which is more clearly shown in the following table:

	SiO ₂ Per cent.	K ₂ O Per cent.	Na ₂ O Per cent.	Total Alkalies. Per cent.	CaO Per cent.	MgO Per cent.	Total Iron Oxides. Per cent.
Coarse granitoid inclusion in tor-granite II. 4. (2)3. 3(4).	57.4	3.98	1.89	5.87	3.68	3.63	3.23
Tor-granite (Saddle Tor) I. (3)4. "2. 3.	71.69	4.59	3.03	7.62	1.49	0.66	2.50
A quarry-granite intrusive into tor-granite (Haytor) I. 3(4). 1. 3.	73.66	5.02	2.89	7.91	0.67	0.45	1.72
A typical aplite (Jordan) . I. (3)4. 1. 2".	76.32	7.51	2.00	9.51	0.40	0.02	0.41

(Analyses by H. F. Harwood.)

In West Dartmoor, variation is still more striking. Notwithstanding this wide range of mass-composition, biotites separated and analysed prove to be

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variably identical, and are associated with the same characteristic accessory minerals.

Essentially the same variation-trend is displayed by many granite complexes, both British and foreign, in which the mass-relation between differentiates and standard types also varies. As applied to such composite granite masses, 'stages of intrusion' imply nothing more than brief local pauses in the intrusion process.

The variation briefly indicated above is closely concerned with the tectonic history of the Dartmoor granite, its anatomy, and its space-form in relation to the country rocks and to the granites farther west. These problems are complex indeed, and admit of amicable and stimulating exchanges of opinion.

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Influence of Nitrogen Dioxide upon the Ignition Temperature of Hydrogen-Oxygen Mixtures.

H. B. DIXON has observed that the ignition temperature of hydrogen-oxygen mixtures may be lowered so much as 200°C. by small quantities of nitrogen dioxide. Hinshelwood^{1,2} and his co-workers, who investigated this reaction afresh, found that the nitrogen dioxide concentration must lie between two definite limits to give the observed effect, and when the nitrogen dioxide concentration is above or below these limits, only a slow combination of hydrogen and oxygen ensues. Up to the present, it has not been possible to give a satisfactory explanation of the phenomenon.

Now, according to Mecke,^{3,4} one of the oxygen atoms in nitrogen dioxide is relatively weakly bound (77 Cal.). On the other hand, in the chain mechanism proposed by Bonhoeffer⁵ and Haber⁶ for the hydrogen-oxygen combination, reactions are involved which are considerably more exothermic than 77 Cal.

It is legitimate to assume that the nitrogen dioxide is especially fitted to take up the energy of the 'hot' molecules produced in these reactions and then dissociates thus: $\text{NO}_2 \rightarrow \text{NO} + \text{O}$. The oxygen atom formed in this manner can then cause further reaction to take place. When the nitrogen dioxide concentration is great enough to form sufficient oxygen atoms, explosion takes place at a lower temperature.⁷ (This is the lower limit of nitrogen dioxide concentration.)

Again, it has been shown⁸ that the reaction I.,



takes place more frequently than the reaction II.,



when it is assumed that the oxygen atom is not very strongly excited, which is, however, scarcely the case in these examples. The three body collision reaction, $\text{O} + \text{H}_2 \rightarrow \text{H}_2\text{O}$, which yields very 'hot' molecules, is likewise slower than reaction I.

Hence it follows that when the nitrogen dioxide concentration rises, the probability of the oxygen atom disappearing through reaction I. becomes greater and greater, until eventually the nitrogen dioxide concentration reaches a point where no explosion due to oxygen atoms develops. (This is the upper limit.) Taking suitable values for the velocity and the mechanism of an individual reaction, it is possible to derive the sharp limiting values of the nitrogen dioxide concentration observed by Hinshelwood (*loc. cit.*). The influence of nitrogen dioxide upon the ignition temperature of CO - O₂ mixtures found by