results are shown in the accompanying diagram (Fig. 1). The currents generated in a thermopile when the radiation from an explosion falls on it, are given as ordinates and the percentage H_2 as abscissæ. The radiation falls very sharply on the addition of 0·07 per cent. H_2, and is still falling slowly when 2 per cent. of this gas is present.

The hydrogen was introduced into an equimolecular mixture of carbon monoxide and oxygen as electrolytic gas.

Since hydrogen has no absorption bands between 2μ and 6μ, it is clear that the reduction of radiation is

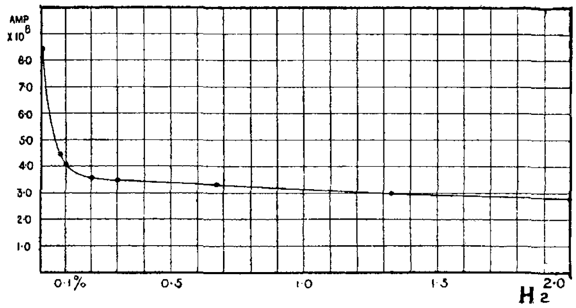

FIG. 1.

not due to absorption in front of the explosion wave. It is also unlikely that the reduction is due to the absorption by water vapour formed in the wave front, for the relation log $R'/R_0=kx$ does not apply. (R' is the radiation emitted in the presence of x per cent. of hydrogen, and R_0 is the radiation from the dry gases.)

When the form of the curve is known with greater exactitude, it should be possible to elucidate the nature of the mechanism by which this reduction is brought about, whether it be due to collisions of H_2O, H_2, or H, with the activated molecules of carbon dioxide, or to some other cause.

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Subsidiary Rectangles as applied to the Formation of Magic Squares.

WITH non-consecutive numbers it is possible to make an 'associated' rectangle 8 × 3. It is not possible to do so out of the first 24 consecutive numbers. In using this 'associated' rectangle 8 × 3 to form a magic square also 'associated,' and 'pandiagonal' with subsidiary rectangles 8 × 3, it is further necessary that the 3 diagonals one way should also sum to the same amount as the rows. This is so in the following rectangle, where the rows and the diagonals from left to right sum each to 120 and the columns each to 45.

1	23	19	24	22	9	20	2
16	12	5	13	17	25	18	14
28	10	21	8	6	11	7	29

By means of this rectangle two formative rectangles can be made according to De la Hire's method, one 24 × 3 for the index numbers with 7 replicas, and one for the radix numbers 4 × 24 with 5 replicas. The resultant magic square will be both pandiagonal and associated with 24 subsidiary rectangles 8 × 3, each of whose 3 long rows will sum to 3480 and each of whose 8 short columns will sum to 1305. The 24 rows, 24 columns, and 48 diagonals of the square will sum to 10,440. The intervals for the radix numbers I have taken at 30 instead of 29 for ease of calculation.

The above is the smallest rectangle that can be constructed, consisting of 3 rows, that will give this dual requirement, namely, to be associated, and for the diagonals one way to sum to the same amount as the rows; 4 × 3, 5 × 3, 6 × 3, and 7 × 3 are unable to provide such rectangles without repeating some numbers. This can be proved by algebra.

In the case of 6 × 3, however, the requirement is not necessary, as squares can be formed in other ways. I give the following examples to demonstrate this:

4 × 3

7	8	14	3
4	14	2	12
13	2	8	9

32 × 24

5 × 3

5	9	14	11	1
4	10	8	6	12
15	5	2	7	11

40 × 24

24	29	14	12	11
5	1	18	35	31
25	24	22	7	12

90 × 54

6 × 3

79	30	5	32	19	75
36	29	67	13	51	44
5	61	48	75	50	1

240 × 120

7 × 3

14	10	33	30	26	12	1
5	20	11	18	25	16	31
35	24	10	6	3	26	22

126 × 54

These rectangles are all associated and have their diagonals from left to right summing to the same amount as the rows, but they all repeat numbers in certain places. If in these places numbers are repeated they are not difficult to construct.

With rectangles with 4 rows the necessity for the diagonals one way summing to the same amount as the rows does not arise, but rectangles 6 × 4 for order 24 are not the smallest that will produce associated squares with subsidiary rectangles 6 × 4. Order 20 can comply with subsidiary rectangles 5 × 4, the whole square being pandiagonal and associated. But order 24 can be composed of 24 rectangles 6 × 4, each one of which is associated and the whole square pandiagonal. This is impossible with subsidiary rectangles 8 × 3 in order 24 or with subsidiary rectangles 5 × 4 in order 20.

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Dec. 20.

The Palæolithic Implements of Sligo.

I THINK that Prof. Macalister and his colleagues have quite fairly stated their opinion (NATURE, Dec. 31, 1927) upon the geological aspect of the sites examined by Mr. Burchell in Sligo. So far as I am concerned, I do not feel entitled to discuss or argue upon the details of this aspect of the matter, for the reason that—as I made clear in my original note in NATURE—I have not yet visited the sites in dispute. I have, however, had abundant opportunities for making an examination of the specimens collected by Mr. Burchell, and of subjecting them to a prolonged and careful examination; and I entertain no doubt whatever that these specimens are humanly flaked, and that their forms and method of flaking are such as were in vogue in Early Mousterian-palæolithic times. Further, I am of opinion that no natural force—or combination of natural forces capable of flaking stone—such as fortuitous pressure, percussion, or thermal action, could in any circumstances produce these forms. This is my sincere belief, and it is because I possess it that I consider it my duty to support Mr. Burchell in this matter.