

presumed astroblemes that initial compressibility of the rock, fine-grained texture and minimal porosity, and frequent discontinuities (bedding and joint surfaces) in the shock-wave path are conducive to extensive development of shatter cones.

We conclude that the shock force which shattered the collar rocks along the southern periphery of the Sudbury Basin came from the north, that is, from the direction of the Sudbury Basin. This is in accordance with expectations if the Sudbury structure is an astrobleme.

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CHEMISTRY

A Simplified Scintillation-counting Technique for assaying $^{14}\text{CO}_2$ in a Warburg Flask

AVAILABLE methods for assaying $^{14}\text{CO}_2$ in Warburg flasks are of two types. The first¹ involves trapping liberated $^{14}\text{CO}_2$ with an organic base, which makes it possible to count efficiently, but at the cost of a rather cumbersome procedure. Trapping with filter paper moistened with sodium hydroxide² or potassium hydroxide^{3,4} provides a convenient method but with some loss of efficiency. The procedure described here is based on the use of a solvent system described by Belcher⁵ that will accommodate up to 3 per cent of a 25 per cent aqueous potassium hydroxide solution with only 3 per cent quenching.

Portions of 0.01 M sodium carbonate containing standardized $\text{Na}_2^{14}\text{CO}_3$ (obtained from the Radiochemical Centre, Amersham) were pipetted into the main compartments of Warburg flasks. Water was then added to bring the total volume to 3 ml. Sulphuric acid (0.2 ml. 6 N) was added from the side arm and the evolved carbon dioxide was trapped in 0.1 ml. 20 per cent aqueous potassium hydroxide contained in the centre well. After shaking for 1 h to ensure complete absorption of the carbon dioxide, the contents of the centre well were transferred with a Pasteur pipette to 5-ml. solvent in a silica counting vial: maximum transfer was ensured by transferring some of the mixture to and fro three or four times. The solvent system consisted of 2,5-diphenyloxazole (PPO) 2 g, 1,4-bis-2-(5-phenyloxazolyl) benzene (POPOP) 25 mg, toluene (500 ml.) and methanol (500 ml.). Reagent-grade solvents were used. The solvent system differs from that described by Belcher⁵ only in that methanol was used instead of ethanol. The solvent system is very sensitive to oxygen quenching, and oxygen-free nitrogen was therefore bubbled through each vial for 1 min before sealing with a well-

Table 1. LIQUID SCINTILLATION COUNTING OF $^{14}\text{CO}_2$ RADIOACTIVITY FROM WARBURG FLASKS CONTAINING STANDARD $\text{Na}_2^{14}\text{CO}_3$

Initial radioactivity (d.p.s.)	Carbonate present (μmole)	Count rate (c.p.s.)	Counting efficiency (per cent)
0	0	0.75	—
24.4	2	19.4	76.4
48.8	4	37.4	75.1
73.2	6	55.4	74.7
97.6	8	74.2	75.3
122.0	10	92.0	74.8
146.4	12	102.9	69.8
170.8	14	110.8	64.1

The counting efficiencies were calculated from the count rate obtained after subtraction of the blank value. It can be shown⁶ that the radioactivity from ^{40}K in 0.1 ml. 20 per cent potassium hydroxide contributes 0.44 d.p.s. towards the blank.

fitting cap. Counting was performed in a Nuclear Enterprises liquid scintillation unit at 20° C. Table 1 shows that the recovery of $^{14}\text{CO}_2$ radioactivity was independent of the amount of carbonate in the flasks up to 10 μmole . After this, the contents of the centre well cease to be completely soluble in the scintillator solution. The method is thus applicable to volumes of carbon dioxide up to about 200 μl .

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Kinetic Evidence for Nucleus Cluster Formation in Solid Decompositions

OVERALL topokinetic equations can be extended to take account of time-dependent nucleation functions other than the random law modified by ingestion^{1,2}; but no analytic treatment of non-random spatial arrangements of nucleation sites has appeared. Apart from photo-micrographs of partially decomposed barium azide showing barium nuclei in clusters and arrays^{3,4}, and some single crystal investigations⁵, there is little published evidence of the need for such a theoretical extension. However, recent kinetic evidence has suggested the existence of non-random arrangements of two kinds.

First, work on α -lead azide⁶ and nickel oxalate⁷, described elsewhere, in which the kinetic form of the acceleratory period changes at $\alpha \sim 0.25$ from a cubic towards a parabolic dependence, is consistent with linear arrays of three-dimensional nuclei which coalesce to form rod-like bodies. Secondly, in some preparations of silver oxide⁸ and silver oxalate⁹ a cubic dependence holds for $\alpha > 0.05$ with negative deviations for $\alpha < 0.05$, the intercept t_0 of the $\alpha^{1/3}$ versus t plot being negative.

This second kinetic form can arise from the growth of nuclei in isolated planar groups. The constituent nuclei first grow independently giving a linear $\alpha^{1/3}$ versus t plot, but later coalesce giving a nearly linear plot with a reduced slope, the number of nuclei in a group being given by the cube of the ratio of the initial and final slopes of the $\alpha^{1/3}$ versus t plot. For the data on a range of neutron-irradiated silver oxalate samples⁹ plotted on a reduced time

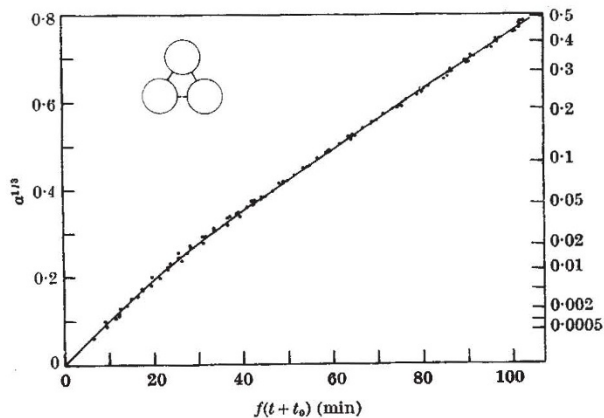


Fig. 1. The reduced plot $\alpha^{1/3}$ versus $f(t + t_0)$ for the thermal decomposition at 126° C of neutron-irradiated silver oxalate. The full line represents the volume development of an equilateral cluster. Data from Fig. 7 of ref. 9