

might not be noticed in the field in the absence of an adjacent control.

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J. N. B. BELL

Department of Botany,  
Imperial College Field Station,  
Silwood Park,  
Ascot

W. S. CLOUGH

Health Physics and Medical Division,  
AERE Harwell

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<sup>1</sup> Bleasdale, J. K. A., thesis, University of Manchester (1952).

<sup>2</sup> Meetham, A. R., *Atmospheric Pollution*, 178 (Macmillan, New York).

<sup>3</sup> *The Investigation of Air Pollution, National Survey Annual Summary* (Warren Spring Laboratory).

## Crystallization *in vivo* of Rhabdophane in Human Lungs

WE have observed an unusual accumulation of inorganic rod-like particles with a mean diameter of about 10 nm in the lungs of two reproduction photographers (Fig. 1). From the electron diffraction of the particles the *d*-spacings were calculated (Table 1).

The X-ray powder diffraction pattern of the isolated lung dust does not show any additional lines except those of quartz which can be traced in every human lung. A semiquantitative X-ray fluorescence analysis showed the presence of the following elements (in order of decreasing frequency): cerium, lanthanum, calcium, neodymium, thorium, praseodymium, yttrium and samarium. In addition; silicon, iron and potassium, which are common in lung tissue, were also detected. Peaks at 1,060 cm<sup>-1</sup>, 623 cm<sup>-1</sup> and 540 cm<sup>-1</sup> in the infrared spectrum indicate that the rare earth elements are combined with phosphate ions.

These results leave no doubt that the particles consist of rhabdophane, (La, Ce, Nd . . .) PO<sub>4</sub>·H<sub>2</sub>O, or at least partly of the rather rare thorium-rich variety brockite. The analysis of the elements contained in the ash of an arc-lamp electrode which had been used in the workshop where both photographers

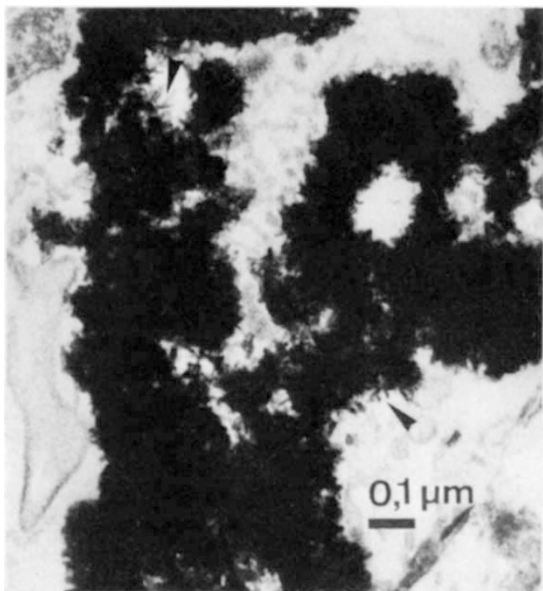


Fig. 1 Electron micrograph of lung tissue: detail of a rhabdophane containing cellular inclusion body.

Table 1 Electron Diffraction Pattern of Lung Dust and *d*-Spacings of Rhabdophane and Brockite

| Lung dust             |                                  | Rhabdophane<br>(ASTM 12-277) |                                  | Brockite<br>(ASTM 15-248) |                                  |            |
|-----------------------|----------------------------------|------------------------------|----------------------------------|---------------------------|----------------------------------|------------|
| <i>d</i> (Å)          | <i>I</i> / <i>I</i> <sub>0</sub> | <i>d</i> (Å)                 | <i>I</i> / <i>I</i> <sub>0</sub> | <i>d</i> (Å)              | <i>I</i> / <i>I</i> <sub>0</sub> | <i>hkl</i> |
| 6.08                  | 30                               | 6.07                         | 60                               | 6.06                      | 40                               | 100        |
| 4.39                  | 60                               | 4.40                         | 80                               | 4.37                      | 70                               | 101        |
| 3.53                  | 50                               | 3.49                         | 60                               | 3.47                      | 50                               | 110        |
| 3.04                  | 90                               | 3.02                         | 100                              | 3.03                      | 100                              | 200        |
| 2.82                  | 100                              | 2.83                         | 80                               | 2.83                      | 70                               | 102        |
| 2.36                  | 20                               | 2.36                         | 40                               | 2.37                      | 30                               | 112        |
| 2.12                  | 40                               | 2.15                         | 80                               | 2.15                      | 70                               | 211        |
| 1.93                  | 20                               | 1.92                         | 40                               | 1.92                      | 30                               | 301        |
| 1.86                  | 40                               | 1.859                        | 60                               | 1.86                      | 50                               | 212        |
| Hexagonal             |                                  | Hexagonal                    |                                  | Hexagonal                 |                                  |            |
| a <sub>0</sub> = 7.02 |                                  | a <sub>0</sub> = 6.98        |                                  | a <sub>0</sub> = 6.98     |                                  |            |
| c <sub>0</sub> = 6.35 |                                  | c <sub>0</sub> = 6.39        |                                  | c <sub>0</sub> = 6.40     |                                  |            |

had worked showed a pattern similar to the lung dust with respect to the rare earth elements. X-ray powder diffraction analysis revealed, however, that in the ash these elements were present as oxides. Therefore, it must be concluded that the inhaled oxides were gradually converted to rhabdophane (or brockite) within the lung tissue. To our knowledge the *in vivo* crystallization of these rare minerals has not been previously observed.

H. STICHER

Institute of Agricultural Chemistry,  
Swiss Federal Institute of Technology,  
Zürich

M. A. SPYCHER  
J. R. RUETTNER

Institute of Pathological Anatomy,  
University of Zürich

## Dimethylnitrosamine in the Human Vaginal Vault

THE high frequency of cancer of the uterine cervix in southern Africans<sup>1</sup> and the general epidemiological features of the disease<sup>2</sup> suggest that chemical carcinogens might be found in infected discharge from the human cervix.

Pathological cervical and vaginal discharges contain cellular matter in various stages of degradation in a "protected" environment at pH (about 5.5), and temperature favourable for chemical change. Discharges are usually infected with a wide variety of microorganisms, often including *Trichomonas*, *Monilia* and *E. coli*. Nitrosamines, well known potent carcinogens<sup>3</sup>, might be synthesized by such organisms or formed when and where amines and nitrites (or possibly nitrates in reducing conditions) are present.

Samples were prepared and dimethylnitrosamine isolated by the technique of Nunn and Du Plessis<sup>4</sup>. Isolation and identification of nitrosamines in biological samples (especially when present in the p.p.b. range), based on final gas chromatograph-mass spectrometry, are the most reliable (L. S. Du P. and J. R. N., in preparation). Our identification of dimethylnitrosamine was based both on gas chromatography (where a peak coincided with that of dimethylnitrosamine under two different sets of conditions) and on the mass spectrum of the component responsible for this peak. This spectrum displayed distinctive peaks at mass 74 (parent ion of dimethylnitrosamine) and at mass 30, which could only have been due to NO<sup>+</sup>, characteristic of nitrosamines. Although the increased intensity of mass 30 could have been due to an ion such as <sup>15</sup>N<sub>2</sub><sup>+</sup>, it is extremely unlikely here.

A detailed examination was made of pooled discharges taken from 100 African patients attending an antenatal clinic in Johannesburg. Specimens were collected at random, the criterion of choice being only the availability of material. Most patients in this first series were pregnant, because the