ing the filtrate tenfold with 1:1 (v/v) sulphuric acid. 1 ml volumes of GC 2 solution were added to 0·4-2·0 ml volumes of nucleic acid solution. The reaction mixtures were made to final volumes of 10 ml with 1:1 (v/v) sulphuric acid. After 30 minutes' reaction time the optical density was measured in Zeiss Elkometer Elko II (420 mμ filter; 3 cm cell). Fresh reagent solutions were used throughout (cf. Sandritter et al., regarding influence of age and method of preparation of reagent on the reaction). Typical results are given in Fig. 1. The optical density for 100 mg nucleic acid is 0·001.

![Fig. 1. Optical density of nucleic acid-galloycyanin complex (Reagent GC 2).](image1)

The sensitivity of the reaction could be increased tenfold by modifying the experimental conditions as follows: Galloycyanin reagent solution (GC 3) was prepared by diluting 1 ml of GC 1 solution with 20 ml 40% (v/v) aqueous methanol. GC 3 solution was used between 24 and 48 hours of its preparation. 0·4-2·0 ml of 0·01% aqueous solution of nucleic acid was made to 2 ml volume and treated with 7 ml of 0·02 N HCl (pH = 1·70) and 1 ml of GC 3. The optical density was measured after 2 hours' reaction time. Results are given in Fig. 2. The optical density for 100 μg nucleic acid is 0·01 which is identical with value obtained by Sandritter et al. who used the more elaborate procedure of precipitating the nucleic acid-galloycyanin complex and dissolving the precipitate in urea before measuring the optical density.

The present data indicate the scope of the nucleic acid-galloycyanin colorimetric reaction in environmental surveys of the type recently reported.

The author is grateful to Prof. J. Krey under whose guidance the work was carried out at the Institute für Meereskunde, Universität Kiel. His thanks are also due to Dr. A. K. Ganguly, Head, Health Physics Division, Bhabha Atomic Research Centre, Bombay, for his interest in the work.

Health Physics Division, R. Viswanathan, Bhabha Atomic Research Centre, Bombay-85, March 6, 1971.


**PHASE STUDIES IN THE SYSTEM Fe₂₅Ca₁₋₂₅Nb₂O₆**

The structures of columbite and fersmite have been studied but the present system is a new study. In order to study the phases developed during the substitution of Fe²⁺ by Ca²⁺, and to investigate the structural relation of fersmite (Ca Nb₂ O₆) with columbite (Fe Nb₂ O₆), we synthesised the columnite, fersmite and the intermediate compositions (Table I) and made an X-ray study.

The samples were prepared by mixing appropriate proportions of the component oxides followed by standard ceramic techniques. All the samples were fired at 1100°C for twenty hours and at 1350°C for five hours in air and quenched to room temperature. The X-ray patterns of these samples were taken by using a 14 cm diameter Debye-Scherrer camera with Fe Kα radiation. The patterns thus obtained were used for the phase studies and determination of lattice parameters. The results are given in Table I.

![Fig. 2. Optical density of nucleic acid-galloycyanin complex (Reagent GC 3).](image2)
TABLE I

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Composition</th>
<th>Molecular weight</th>
<th>Colour</th>
<th>Density</th>
<th>Phases present</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fe0.4Ca0.6Nb2O6</td>
<td>334.82</td>
<td>Light grey</td>
<td>4.55</td>
<td>Columbite + Fersmite</td>
</tr>
<tr>
<td>B</td>
<td>Fe0.6Ca0.4Nb2O6</td>
<td>314.64</td>
<td></td>
<td>4.60</td>
<td>Columbite + Fersmite</td>
</tr>
<tr>
<td>C</td>
<td>Fe0.4Ca0.6Nb2O6</td>
<td>328.46</td>
<td>Grey</td>
<td>4.62</td>
<td>Fersmite</td>
</tr>
<tr>
<td>D</td>
<td>Fe0.2Ca0.8Nb2O6</td>
<td>325.28</td>
<td></td>
<td>4.65</td>
<td>Fersmitie</td>
</tr>
<tr>
<td>E</td>
<td>Ca4Nb2O6</td>
<td>322.10</td>
<td>Light brown</td>
<td>4.78</td>
<td>Fersmite</td>
</tr>
</tbody>
</table>

It is observed from Table I. that the synthetic fersmitie is isostructural with the naturally occurring mineral, with a single phase. The lattice parameters of the synthetic and naturally occurring minerals are

<table>
<thead>
<tr>
<th>Lattice dimensions in Å</th>
<th>Author</th>
</tr>
</thead>
<tbody>
<tr>
<td>a 5.706  b 15.09  c 5.232</td>
<td>Hess and Transipour</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Present study</td>
</tr>
</tbody>
</table>

It is expected that on introduction of a bigger ion Ca2+ (r = 0.99 Å) substituting Fe2+ (r = 0.74 Å), the lattice should expand. It is observed that the lattice increases along a0 and c0 axes, whereas along b0 axis it remains constant. Even on introduction of 20% of Ca2+ the fersmitie phase appeared, but the lines of fersmitie were very faint. On further substitution the lines due to fersmitie were predominant. On introducing 60% Ca2+ the columbite phase completely vanished and only one phase of fersmitie appeared. From this it can be inferred that the columbite and fersmitie are isostructural, i.e., the MO6 polyhedra are linked together in chains along a0 axis and the neighbouring octahedra share edges.

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ELECTRIC DIPOLE MOMENTS OF SOME LESS STUDIED ALIPHATIC AMINES

Electric dipole moments for normal as well as isopentylamines have not been reported earlier1 except for the first members, i.e., n-pentylamine2-3 and isopentylamine.2 The solution moments of alkylamines, in general, are found to be higher than their theoretically calculated or gaseous moments. Presence of association through hydrogen bonding and a positive solvent effect have been suggested as the main factors governing this increase. In the present paper the observed electric dipole moments of isopentylamine, disopentylamine and triisopentylamine in benzene have been analyzed in the same light. The moments for the last two amines are entirely new to the literature.

Halverstadt and Kumler’s standard equation4 for polarization at infinite dilution (P2∞) was employed for evaluation of the electric dipole moments from the static dielectric constant and the specific volume data of amines in benzene solution. The detailed techniques have been described elsewhere.5-6 The variations of the dielectric constants and the specific volumes were found to be linear with concentration of solute (ranging from 0.009 to 0.01 by weight fraction). The constants, α, β, ε1 and ν1 appearing in Halverstadt-Kumler’s equation, were evaluated by the method of least squares.7 Benzene (S. Merck, G.R.), isopentylamine, disopentylamine and triisopentylamine (all from BDH, England) were further purified by distillation in a quickfit apparatus under suitable conditions and the fractions boiling at 79-5°C, 95-96°C, 187-188°C and 234°C respectively were collected for use. The measurements were made at 30°C. The results are summarized in Table I,