is not in very good agreement with Le Mesurier's data, it clearly indicates that a specific gravity of 4.10 is too low.

Single crystal x-ray diffraction patterns of carminite were obtained by both the precession and Weissenberg methods using CuK_α radiation. The levels $h0l$, $h1l$, $0kl$, and $1kl$ were recorded by the precession method, and $hk0$, $hk1$, and $hk2$ by the Weissenberg method. The crystallographic axes were assigned according to the convention $b > a > c$, yielding axes which corresponded in orientation and ratio to those reported by Foshag on the basis of the morphology. Systematic extinctions indicate that the space group is either $Amaa$ or $A2aa$ (C_{2v}^{13} or D_{2h}^{20}). $Amaa$ is the more likely, since no piezoelectric effect could be detected by the Geibe-Schiebe method and the morphology is holohedral. The unit cell data is given in Table 1. Powder diffraction data, using FeK_α radiation, is given in Table 2. All intensities were estimated visually.

On the basis of the unit cell data obtained and the composition $PbFe_2(AsO_4)_2(OH)_2$, the number of formula weights per cell were calculated using both reported values of the specific gravity. For specific gravity 4.10, $Z = 5.99$, and for specific gravity 5.22, $Z = 7.64$. Examination of the two possible space groups shows that crystallographically equivalent atoms must lie in four-, eight-, or sixteen-fold positions. These positions provide no arrangement which would accommodate six lead atoms per unit cell. On the basis of the space group, it seems reasonable to assume that eight formula weights per cell is the correct figure. The calculated specific gravity for $Z = 8$ is 5.46, a 4.5% deviation from Le Mesurier's value and a 5% deviation from the maximum value obtained for the Mapimi material.

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SUBSTITUTION OF Fe^{3+} FOR Al^{3+} IN SYNTHETIC SPESSARTITE

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With a view toward producing garnets with magnetic ions in only the dodecahedral and octahedral sites (see Refs. 1 and 2), we have attempted

to synthesize, at atmospheric pressure, the garnets $Mn_3Fe_2(SiO_4)_3$* and $Mn_3Cr_2(SiO_4)_3$ by means similar to those used to synthesize spessartite (4, 5) and uvarovite (6, 7). The latter are the only two silicate garnets which, to date, have been rather directly synthesized. In these experiments, garnets were not produced. We usually obtained spinel-type structures; in some cases, $MnSiO_3$ (rhodonite) was obtained. Also, in some cases, the devitrification of the silica to tridymite occurred.

Numerous experiments were carried out to determine to what extent Fe^{3+} could be made to replace Al^{3+} in $Mn_3Al_2(SiO_4)_3$. Many difficulties were encountered, especially in the formation of more than one phase and the segregation of phases. The experiment which led to the highest substitution for Al^{3+} by Fe^{3+} involved the mixing of ingredients such that 30 atomic per cent of the Al^{3+} would be replaced by Fe^{3+}. The thoroughly mixed and compacted reactants were kept at 1250° C. for 20 hours and furnace cooled. It was obvious from the powder pattern that all of the Fe^{3+} had not replaced the Al^{3+}. However, the garnet phase formed has a lattice constant of 11.658 Å or 0.043 Å larger than that of the pure synthetic spessartite.

It has been shown that when partial substitution is made for Fe^{3+} in yttrium-iron garnet by other trivalent ions (8) the solid solutions very nearly follow a linear lattice constant law. We may assume that solid solutions between $Mn_3Fe_2(SiO_4)_3$ and $Mn_3Al_2(SiO_4)_3$ would also very nearly follow a linear lattice constant law.† Now the difference in lattice constant between synthetic andradite and grossularite (9) is 0.20 Å. Then, if the lattice constant of $Mn_3Fe_2(SiO_4)_3$ were 11.82 Å (that is, 0.20 Å greater than that of spessartite), it would appear that in our experiments at atmospheric pressure, a maximum of about 20% of the Al^{3+} was replaced by Fe^{3+}.

The Cr^{3+} ions prefer the octahedral sites in the garnets (see Ref. 8), but attempts to substitute Cr^{3+} for Al^{3+} in spessaritite were unsuccessful. The substitution of Co^{3+} for Al^{3+} was also attempted, but as expected, positive results were not obtained.

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* Coes (3) has reported the high pressure synthesis of $Mn_3Fe_2(SiO_4)_3$ garnet. A sample of this garnet obtained from Mr. Coes, after this note was written, has a lattice constant of 11.82 Å, as obtained from a Buerger precession photograph.

† However, solid solutions between silicate garnets and the garnets in which all metal ions are trivalent do not follow a linear composition vs. lattice constant law (see, for example, Ref. 5).

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MACRO POINT COUNTING

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Macro point counting, and a stage to facilitate its application to hand specimens, has recently been discussed by Emerson (1958, p. 1000). In 1953 the author exhibited a method of macro point counting before the Mineralogical Society of London. Five years experience confirms the value of this method, which is considered to be both simpler and superior to that described by Emerson.

The method is based on a graticule prepared by the author and his senior colleague, Dr. A. T. J. Dollar, for a variety of petrological uses. The graticule (Fig. 1) has 676 equally spaced points, and a co-ordinate reference system. It can be reproduced photographically on any scale to suit the requirements of the task. When used for modal analysis the scale is varied to suit the grain-size and porphyritic character of the rock to be analysed. For routine hand specimen analysis the graticule is printed on high resolution photographic plates, but for field use it can be prepared on plastic film. Point counting requires the identification of the mineral grains that occur at each of the equally spaced points. For this purpose the graticule is superior to the use of Zip-E-Tone, suggested by Jackson and Ross (1956), which obscures the mineral to be identified. In most cases there is no difficulty in deciding which mineral occurs at the exact centre of the circle, but when doubt arises, this is resolved by the use of a cross-wire (or transparent protractor in the field) aligned on the graticule.

It has been found by experience that porphyritic and coarse-grained rocks are not adequately sampled by micro analysis alone. Often a combination of macro and micro point count analysis is found to produce the most satisfactory results. If the object of the point count is to