

carboxyl group. A plane can be drawn through the five ring atoms, from which the displacements are

$$\begin{aligned} O_1 &-0.0076, C_2 +0.0077, C_3 -0.0026 \text{ \AA}, \\ C_4 &-0.0035, C_5 +0.0086 \text{ \AA}, \end{aligned}$$

all of which are less than the standard deviations. On the other hand a plane taken through the four carbon atoms of the ring, is very accurately planar; the deviations are

$$C_2 -0.0003, C_3 +0.0005, C_4 -0.0005, C_5 +0.0003 \text{ \AA},$$

and the ring oxygen lies 0.0224 Å below this plane, a displacement which is substantially greater than the standard deviation. In relation to this plane the carboxyl group is twisted by nearly 2° in a direction away from the ring oxygen, the displacements being

$$C_1 -0.0458, O_2 +0.0442, O_3 -0.0261 \text{ \AA}.$$

The geometry of the carboxyl group is somewhat unusual; the longer bond of 1.29 Å is normal, the shorter, 1.18 Å, rather below average, but the relative size of the angles C–C–OH and C–C=O is reversed. Typical values are C–C–OH 116°, C–C=O 122° with O=C–OH 122°. In  $\alpha$ -furoic acid the values are 119°, 117° and 123° respectively. It is also to be noted that the configuration of the carboxyl group is reversed compared with  $\alpha$ -thiophenic acid and  $\alpha$ -selenophenic acid (Nardelli, Fava & Giraldi, 1962), in both of which the hydroxyl group faces the ring hetero-atom. Both sulphur and selenium compounds display normal geometry in their angles, although there is a certain amount of distortion of the angles bringing the carboxyl group nearer to the hetero-atom. It seems therefore that although the configuration is reversed in  $\alpha$ -furoic acid there is still an

attraction between carboxyl group and the ring oxygen atom. The exocyclic bond C<sub>1</sub>–C<sub>2</sub> is remarkably short, 1.41 Å, although it is comparable with the values observed for 1- and 2-naphthoic acids by Trotter (1960, 1961). This bond is usually shortened if the cyclic system is a conjugated one, but one would not expect shortening of quite such magnitude in  $\alpha$ -furoic acid which is not strongly aromatic. The acid forms hydrogen-bonded centrosymmetric dimers, the molecules being nearly co-planar, the distance O–H···O being 2.54 Å.

Because the *c* axis is so very short, the *z* parameters are not very reliable—as the standard deviations indicate. A three-dimensional analysis is needed to make the results really reliable; this would clarify the position of the C<sub>5</sub> atom and make conclusions about the ring more dependable.

The author would like to record his thanks to Dr J. H. Robertson for his continual advice and encouragement, and to Dr T. H. Goodwin for his valuable comments on the results of the refinement.

### References

- BAK, B., HANSEN, L. & RASTRUP-ANDERSEN, J. (1955). *Discuss. Faraday Soc.* **19**, 30.  
 BERGHUIS, J., HAANAPPEL, IJ. M., POTTERS, M., LOOPSTRA, B. O., MACGILLAVRY, C. H. & VEENENDAAL, A. L. (1955). *Acta Cryst.* **8**, 478.  
 GOODWIN, T. H. & THOMSON, C. M. (1954). *Acta Cryst.* **7**, 166.  
 NARDELLI, M., FAVA, G. & GIRALDI, G. (1962). *Acta Cryst.* (In the press.)  
 TROTTER, J. (1960). *Acta Cryst.* **13**, 732.  
 TROTTER, J. (1961). *Acta Cryst.* **14**, 101.

## Notes and News

*Announcements and other items of crystallographic interest will be published under this heading at the discretion of the Editorial Board. The notes (in duplicate) should be sent to the General Secretary of the International Union of Crystallography (D. W. Smits, Mathematisch Instituut, University of Groningen, Reütdiepskade 4, Groningen, The Netherlands).*

### International Union of Crystallography

The Executive Committee of the Union much regrets to have to announce that the Technical Editor of *Acta Crystallographica*, Professor R. W. Asmussen, has expressed a wish to be relieved of his task with the completion of the current volume of the journal. Professor Asmussen has served as Technical Editor since May 1958, when he succeeded Dr R. C. Evans. The Union, and the community of crystallographers, is much indebted to him for

his work on the journal, which during his tenure of office considerably expanded in size, and for the painstaking way in which he has carried out his duties.

No successor to Professor Asmussen has been found. Considering the increasing amount of work involved, the Executive Committee feels that the time has come to appoint a full-time technical editor for *all* Union publications. Attention is drawn to the relevant advertisement in this issue.

### Book Reviews

*Works intended for notice in this column should be sent direct to the Editor (A. J. C. Wilson, Department of Physics, University College, Cathays Park, Cardiff, Great Britain). As far as practicable books will be reviewed in a country different from that of publication.*

**Towards Information Retrieval.** By R. A. FAIRTHORNE. Pp. xxiv+211, 15 figs. London: Butterworths. 1961. Price 40s.

Crystallographers have always been interested in information retrieval, an early example being the list of all struc-

tures known in 1923 in Ewald's book 'Kristalle und Röntgenstrahlen'. Out of this interest has grown the continuing series of *Strukturbericht* and *Structure Reports*; indexes of a conventional but very thorough type have sufficed for retrieval of the information stored in these. Since its inception the International Union of Crystallo-

graphy has been represented at many of the international discussions and congresses concerned with information and information retrieval, beginning with the UNESCO conference on physics abstracting in 1949, and ending (so far) with the Conference on Scientific Information in the Fields of Crystallography and Solid-State Physics held in Japan in October 1961. The Union has also always been fully represented at the meetings of the ICSU Abstracting Board.

It is against this background that it is worth while to include an account of Fairthorne's book in *Acta Crystallographica*. It consists of a reprint of sixteen published papers, ranging from the classical 'The Mathematics of Classification' published in the *Proceedings of the British Society for International Bibliography* in 1947, to 'Basic Postulates and Common Syntax' from a book published in 1961. Fairthorne has been active in the field of information, classification, and retrieval from the beginnings of the post-war explosion of this subject, and his collected papers make a reasonably coherent survey of the basic theory, though there is hardly a word in the book dealing with the practice. One's way through the book is eased by a preface by the author himself and 'comments' by L. M. Bohnert and C. N. Mooers. A very wide range of mathematical techniques is involved, ranging from Boole to Brouwer, and from lattice algebra to generating functions. The first paper, in fact, makes a certain pretence of celebrating the centenary of the publication in 1847 of Boole's essay on the calculus of deductive reasoning. The book thus makes heavy demands on its readers, and there can be few people outside the narrow field of information retrieval who will be able to read it without doing a good deal of homework on the principles invoked.

There are just over ten pages of index, compiled by C. N. Mooers. The index is detailed and in places amusing. It is a relief to find that 'Abel' refers to Genesis, and not to group theory.

A. J. C. WILSON

*University College  
Cardiff, Wales*

### **Structural Inorganic Chemistry.** By A. F. WELLS.

Pp. xxiii+1055, with 363 figs. 3rd ed. Oxford: Clarendon Press. 1962. Price 84s.

The well-known book by Dr Wells has now appeared in a third edition, 45% more voluminous than the second edition of 1950. To quote the author, 'the great activity in this field during the past ten years, the addition of a chapter on the geometrical basis of crystal chemistry, and the fact that it is more difficult to write concisely than discursively, have together led to a considerable increase in length'.

As before, the book is divided into two parts. The first is a general presentation of the following topics: the covalent bond, interbond angles and bond lengths, ionic crystals, the geometrical basis of crystal chemistry, the crystalline state, and the experimental methods of structural chemistry. Here the chapter on the geometrical basis of crystal chemistry replaces the chapter in the earlier edition dealing with states of aggregation. In this new chapter the author puts forward his views regarding the geometrical aspects of crystallography which he has developed in a number of papers, and which are both

elegant and instructive. I consider that this chapter will be particularly useful to the chemist whose knowledge is mainly limited to finite groups of atoms in liquids and gases and who wants to learn about the infinite complexes of the solid state.

Significant changes in the other chapters of Part I include the addition of some pages dealing with the ligand field theory, a more extensive presentation of lattice defects and disorder, and, in the chapter on experimental methods, some new paragraphs on neutron diffraction and nuclear and electron magnetic resonance. One could perhaps wish for a more penetrating treatment of some of these subjects, especially of the ligand field theory, which has proved so useful in the interpretation of transition metal complexes. But it is evident that the author has tried to avoid an undue increase in the volume of Part I. Consequently there is a risk that the presentation of complicated problems may be too condensed to be of any real value.

The second part of the book is, as before, devoted to a systematic description of the structures of inorganic substances. It has grown a little more than the first part and now fills 72% of the book. As presented in the second edition, this part has been extremely useful, and I am sure that many users of that edition will now be very glad to obtain it in a more up-to-date form. There are many situations when one does not have the opportunity of consulting *Structure Reports* for a reference or for a short general description of a structure and it is on these occasions that it is most useful to have Dr Wells' book at hand. I think the same will prove to be the case with the third edition. I have not made any tests of the reliability of Part II, but one must bear in mind that such a wealth of material as is found here cannot be collected and processed without omissions and errors. To mention just one detail, one would prefer to have the layer sequences and stacking faults of the cadmium dihalides (p. 348) and carborundum (p. 769) treated as consequences of crystal growth by means of growth spirals.

In mentioning the usefulness of Part II of Dr Wells' book, I have perhaps regarded this section as a sort of a handbook. The author has stressed, however, that the expansion of the book 'does not imply that the aim has been to produce an encyclopedic work of reference'. Let us hope with the author 'that there are still students with sufficient time (and interest) to dip into a book for reasons other than to find a concise selection of the facts required for a particular examination'. I think this book has very much to give students belonging to this category.

G. HÄGG

*Institute of Chemistry  
University of Uppsala  
Sweden*

**Chladni figures — a study in symmetry.** By MARY D. WALLER. Pp. 163, plates 47. London: Bell. 1961. Price 42s.

This posthumous work is remarkable for the new light which it sheds on an old subject. In 1932 an ice-cream vendor in the street asked the author if she could explain a phenomenon he had noticed. When a small piece of the dry-ice from the box holding his ice-creams, was