percent of its contributions written by a single author. Of course, most of the writers for this journal probably classify themselves as physicists rather than as chemists.

The real frontier for the individual in science, however, would appear to be in mathematics. In 1950, 98 percent of the papers in the *American Mathematical Monthly* were written by individuals.

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Soda Fe-Mn Pegmatite Phosphates

The crystallography and thermal relations of alluaudite, dickinsonite, and fillowite, the last three minerals for which data are given in Table 1, are here discussed; no new data have been obtained for natrophilite (Table 1) or the little-known varulites. Each of these five soda-phosphate minerals consists of a solid solution Fe-Mn series. The first two minerals listed, chondrodite and fayalite, are silicates; they are included to make clear the orientation used, which is that of chondrodite with $c < a$. The olivines (represented in Table 1 by fayalite) are isotypous with the pegmatite phosphate triphylite. The latter has a crystal structure similar to but not identical with that of natrophilite (*1*). The new unit-cell data for the last three minerals of the table were obtained from Chanteloube alluaudite and Branchville dickinsonite and fillowite. For Black Hills ferrodickinsonite or arrojadite (*2*), $a = 24.78$, $b = 10.05$, and $c = 16.51$ A.

In a series of thermal experiments it was found that the Black Hills ferrodickinsonite, when heated for a day in air, alters to alluaudite between 485 and 555°C. On the other hand, Chanteloube alluaudite may be heated for a day in air to 990°C without change in its x-ray powder diffraction pattern; it melts close to 1000°C. Ferrodickinsonite, when heated for a day in a platinum envelope in a sealed and evacuated capsule made of Vycor glass tubing, inverts to ferrofillowite at 850°C. The Branchville fillowite when similarly heated to 960° does not show an appreciable change in x-ray powder diffraction pattern. Some cristobalite, presumably developed by the action of Na on the Vycor glass, forms at temperatures of 800°C and above. Unless this involves a significant change in composition, it seems probable that heating to 850°C causes dickinsonite to undergo a reconstructive transformation yielding fillowite.

Heated in air for 46 hr at 885°C, fillowite yields a diffraction pattern rather similar to but far from identical with that of alluaudite. This material is being further investigated. Some of the diffraction patterns from the ferrodickinsonite heated in air above 550°C are not quite identical with that from alluaudite; the small differences will be discussed in a detailed paper to be published elsewhere. The heating experiments were conducted originally to find out at what temperature water assumed to be present was lost; the results indicate that water does not play an essential role in any of these structures (*3*).

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References and Notes

1. A. Byström, "The structure of natrophilite," *Arkiv Kemi.* **17B**, No. 4 (1943).
2. D. J. Fisher, "Arrojadite is a ferro-dickinsonite," *Am. Mineralogist* **39**, 676 (1954).
3. The ferrodickinsonite came from the Headden collection of Harvard through the courtesy of Clifford Frondel, who also supplied the fillowite. The Chanteloube alluaudite was furnished by F. A. Bannister of the British Museum, Kensington.

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Table 1. Silicate-phosphate crystal data. *a*, *b*, and *c*, lengths of the *a*, *b*, and *c* edges of the unit cell; *d*, spacing.

Cations	Mineral	Crystal system	*a* (A)	$d_{(100)} = a \sin \beta$ (A)	*b* (A)	*c* (A)	$d_{(001)} = c \sin \beta$ (A)	β	Unit cell vol. (A^3)	Specific gravity
Mg Mg	Chondrodite	Monoclinic	10.29	9.73	4.74	7.89	$7.45 = 5 \times 1.49$	109° 02′	364	3.20
Fe^{II} Fe^{II}	Fayalite	Orthorhombic	10.61	10.61	4.81	6.17	$6.17 = 4 \times 1.54$	90° 00′	315	4.14
Li Fe^{II}	Triphylite	Orthorhombic	10.36	10.36	4.68	6.01	$6.01 = 4 \times 1.50$	90° 00′	291	3.58
Na Mn	Natrophilite	Orthorhombic	10.54	10.54	4.98	6.33	$6.33 = 4 \times 1.58$	90° 00′	332	3.47
Na Fe^{III}	Alluaudite	Monoclinic	11.99	10.93	2(6.22)	6.38	$5.81 = 4 \times 1.45$	114° 20′	867	3.58
NaMn	Dickinsonite	Monoclinic	2(12.44)	2(11.98)	2(5.05)	16.68	$15.98 = 10 \times 1.60$	105° 41′	4041	3.41
NaMn	Fillowite*	Rhombohedral	15.25			43.32			8730	3.43

* The optic axial angle (2V) is 30° +. The lattice symmetry lacks a mirror (*m*), as kindly pointed out by J. D. H. Donnay, but has a 3-fold axis.