Mine air is usually very humid, and the air would have to be dried before passage through a radon scrubber because water vapor decomposes the fluorinating chemicals. Industrial air-drying units containing silica gel desiccant or moisture-condensing coils might be used for this purpose. A complete air-purification system for a very active mine area, such as a working stope, might consist of the following components (in series): (i) an air-drying unit; (ii) a fluorinating unit; (iii) a halogen vapor-trapping unit (containing soda lime or activated alumina); and (iv) a blower for circulating the air through the three units and the external area. Only the air passing through the purification system would be dried, and, if necessary, it could be rehumidified for the comfort of the miners.

The lifetime of a bed of fluorinating chemical in a system of this type would depend on the water content of the air after drying, since the radon content of air is completely negligible in a chemical sense. A radon concentration of 100 pc/liter corresponds to only 6.5×10^{-16} g/liter, for example; this can be compared with 0.0114 g/liter of water vapor in air with a relative humidity at 25°C of 50 percent and 8.0×10^{-7} g/liter in extremely dry air with 1 part per million of residual water vapor (by volume). It is apparent from these numbers that the bed would be depleted by reaction with water vapor rather than by reaction with radon.

Several physical methods have been used for the collection of radon for analysis, including low-temperature condensation of the element (*10*) and adsorption of the element on activated charcoal and silica gel at −80°C (*11*). Both the physical and the chemical methods warrant further study for the decontamination of mine air. Some of the same problems are encountered with both physical and chemical methods. Water vapor and carbon dioxide saturate charcoal and silica gel, for example, and must be removed before radon can be adsorbed on these materials.

The halogen fluoride–antimony pentafluoride compounds probably can be used for the analysis of radon in air. Preliminary tests have shown that 5 pc of ^{222}Rn can be detected in a cartridge device with standard γ-counting equipment after equilibrium between radon and radon daughters has been established (*12*). Since the air in a uranium mine may contain 30 pc or more of ^{222}Rn per liter, a relatively small volume of air should provide an adequate sample for analysis.

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12. Gamma rays of ^{214}Bi and ^{214}Pb in equilibrium with radon were counted with a lithium-drifted germanium detector (Ortec model 8101-0325) and a 4096-channel analyzer (Packard).
13. I thank H. H. Hyman for advice and helpful discussions, I. Ahmad for analyses of γ-ray spectra, C. Williams for technical assistance, and T. Surles for samples of $CsBrF_6$ and $RbBrF_4$. Work was performed under the auspices of the U.S. Atomic Energy Commission.

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High-Temperature Superconductors, the First Ternary System

Abstract. *A new system of high-temperature superconductors is reported. The compounds, $Mo_{6-x}A_xS_6$ where A is Cu, Zn, Mg, Ag, Cd, Sn, or Pb, are rhombohedral with $a \simeq 6.5$ angstroms and $\alpha \sim 90°$. The transition temperatures range from ~2.5°K for the Cd compound to ~13°K for the Pb compound.*

During the last few years a number of new superconductors have been discovered among the transition metal chalcogenides. Most of these are layer compounds in which the sequence of layers is -S-S-M-S-S-M-, where M is a transition metal. The metal-to-metal interactions between layers are weak and the compounds have a pseudo two-dimensional network of metal atoms. It is possible to intercalate these compounds with, for example, alkali metals, and in this case the highest reported superconducting transition temperature is ~4.5°K for K_xMoS_2 (*1*). However, where a structure containing a true three-dimensional network of metal atoms is synthesized from similar elements, the transition temperatures are much higher, for example, ~13°K for $Li_{0.3}Ti_{1.1}S_2$ (*2*).

In our search for new chalcogenides with a three-dimensional network of metal atoms, we found an entirely new system of high-temperature superconductors: $Mo_{6-x}A_xS_6$, where A is Cu, Mg, Zn, Cd, Ag, Sn, or Pb. These compounds were first synthesized by Chevrel *et al.* who mixed the elements or the sulfides in quartz ampoules at

Table 1. Superconductivity of ternary molybdenum sulfides.

Composition	Superconducting transition temperature (°K)	Lattice constants * (Å)			
		Rhombohedral axes		Hexagonal axes	
		a	*α*	*a*	*c*
$Mo_{4.5}Cu_{1.5}S_6$	10.9–10.8	6.51	95°18′	9.63	10.18
Mo_5ZnS_6	3.0– 2.7	6.489	94°41′	9.545	10.282
$Mo_{4.8}Ag_{1.2}S_6$	8.9– 8.4	6.48	91°57′	9.32	10.83
Mo_5CdS_6	2.4– 2.3	6.517	92°49′	9.440	10.720
$Mo_{5.1}Mg_{0.9}S_6$	2.5– 2.4	6.510	93°35′	9.490	10.550
Mo_5SnS_6	11.3–10.9	6.52	89°44′	9.19	11.34
$Mo_{5.1}Pb_{0.9}S_6$	13.2–12.5	6.54	89°28′	9.20	11.43

* The lattice constants for the Cu compounds are from this report. All the others are from (*3*).

1100°C (*3*). They are rhombohedral with $a \simeq 6.5$ Å and $\alpha > 90°$ for the small cations such as Cu, Mg, Zn, Cd, and Ag; for the larger cations $\alpha < 90°$. Since the rhombohedral angles are very close to 90°, the metric symmetry of these compounds is almost cubic. Although the structural arrangement is not yet known, it is reasonable to assume that these compounds are not of an intercalation nature as the ratio of cation to sulfur is unity.

We anticipated superconductivity in most of these compounds, and our expectations were verified as shown in Table 1. Because of their high transition temperatures, one could speculate that their arrangement should also be pseudocubic (*4*). In any event this new system of superconductors illustrates once again the incompatibility between pseudo two-dimensional metal networks, as in the layer compounds, and high transition temperatures. A detailed report together with the crystal structure of these compounds will be published elsewhere (*5*).

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Genetic Variation in Human Erythrocyte Acetylcholinesterase

Abstract. *A method for solubilization of human erythrocyte membranes was developed and used to survey 70 unselected human blood samples for isozymic variation of stromal acetylcholinesterase. Three variants were observed. Pedigrees of families studied by this method indicated that this variation represented the phenotypic expression of two codominant alleles at a single locus.*

Familial reduction in the activity of human erythrocyte acetylcholinesterase (AChE) (E.C. 3.1.1.7) has been reported (*1*); reduction in enzyme activity had no associated symptoms. This report prompted us to examine AChE for normal, genetically determined isozymic variation. This enzyme is a firmly bound component of the human erythrocyte membrane (*2*). The membrane, or stroma, is a complex framework of proteins and lipids. It has been characterized by electrophoresis and found to consist of several classes of polypeptides (*3*, *4*), which can be distinguished by their molecular weights (*4*, *5*). In most studies of this kind, however, strong protein-denaturing agents have been used, such as urea (*6*) and sodium dodecyl sulfate (*4*, *7*), which destroy the catalytic activity of enzymes. To examine the possibility of isozymic variation by gel electrophoresis, we devised a rapid method for the solubilization of human erythrocyte membranes without loss of AChE activity.

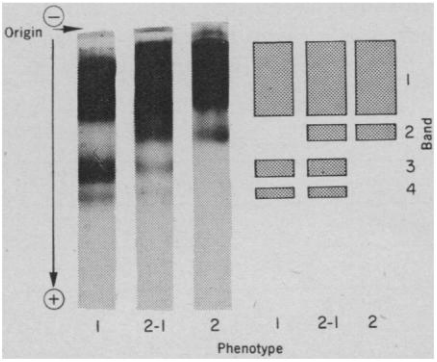

Fig. 1. Photograph and diagram of human erythrocyte AChE isozymes in the three AChE phenotypes: 1, 2-1, and 2. Band 3 is not always heavier in phenotype AChE 1 than in phenotype AChE 2-1, as in the photograph.

Venous blood was collected in tubes containing heparin and centrifuged, and the plasma was removed. The cells were washed three times in isotonic saline and hemolyzed in 1.4 volumes of distilled water and 0.4 volume of toluene (*8*). After vigorous shaking, the mixture was centrifuged at 6000*g* for 20 minutes. The stromata could be seen between a top layer of toluene, which contained dissolved lipids, and the bottom layer, which contained the water-soluble hemolyzate. Both toluene and hemolyzate were removed by aspiration. The extraction of stromata was repeated once, after which the stromata were pink or white. They were suspended in a solution of 5 percent Triton X-100 in $0.01M$ phosphate buffer, *p*H 7.4; the volume of the suspension was made equal to the original volume of packed cells. The suspension was stored at −10°C.

Disc electrophoresis in polyacrylamide gels was done essentially by the method of Clarke (*9*), with 7 percent gels in glass tubing 90 mm long with an inner diameter of 5 mm. Stromal samples diluted 1 : 5 were applied to the top of the gel columns in Sephadex G-200. Electrophoresis was conducted at 2 ma per tube for 45 to 60 minutes. Activity of AChE on these gels was detected histochemically by a copper-thiocholine technique (*10*).

In a survey of blood samples from 70 randomly selected adults, all samples showed a slowly migrating major zone of activity (Fig. 1, band 1). In addition there were up to three minor components, which migrated faster than the major zone. Bands 3 and 4 appeared in samples from 53 individuals (76 percent); band 2 alone occurred in 5 samples (7 percent); and all 3 components occurred in 12 samples (17 percent). Isozymic variation was not associated with significant differences in total AChE activity. These patterns were reproducible when several determinations were made on the same sample and when several samples were taken at different times from the same individual.

When benzoylcholine was used as substrate, according to the method of

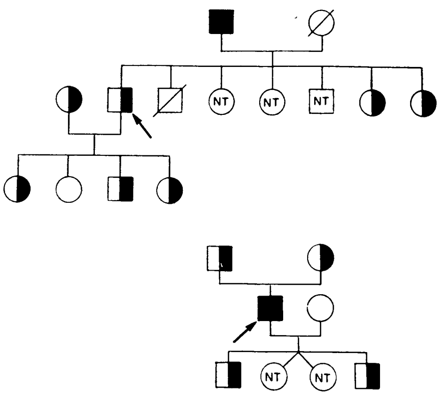

Fig. 2. Pedigrees showing mode of inheritance of AChE phenotypes. Squares are males; and circles, females; open symbols are AChE 1; solid, AChE 2; and half-solid, AChE 2-1; NT means not tested; and the diagonal line indicates that individual was deceased. Arrows refer to probands.