Communications

Radiochemical Separations by Isotopic Exchange: a Rapid, High-Decontamination Method for Silver

It has been reported by Langer (*1*) that the exchange of silver ion between a precipitate of silver chloride and a solution of silver nitrate reaches isotopic equilibrium very rapidly. Because of the low solubility of silver chloride, a very favorable ratio exists at equilibrium between the silver atoms in the precipitate and the silver atoms in the solution. For this reason, if silver chloride is added to a solution containing only trace amounts of radioactive silver, a high percentage of this silver will have exchanged with the silver in the precipitate by the time equilibrium is attained. Use has been made of this fact to develop a rapid, high-decontamination, single-step method for the separation of traces of radioactive silver from a solution containing other radioactive species (*2*).

Platinum gauze is coated with metallic silver by plating (*3*) from an alkaline cyanide bath. The silver is then changed to silver chloride by reversing the current and electrolyzing the silver in an HCl solution.

To separate radioactive silver from other activities (except halides), the "silver chloride electrode" is immersed for 5 min at room temperature in about 10 ml of an acid solution containing the active material. The solution may be stirred magnetically. The electrode is removed and washed with a stream of 1:1 HNO_3 for 1 min.

Yields of radioactive silver from this procedure are given in Table 1 for varying temperatures, amounts of silver chloride, and times of immersion. The exchange rate appears to be independent of the nitric acid concentration in the range of 0.1 to 4*M*, whereas at 8*M* HNO_3 only 92 percent and at 16*M* HNO_3 only 50 percent is exchanged in 5 min at 25°C. The exchange is also independent of hydrochloric acid concentration in the range 0 to 0.6*M*, whereas in 1.2*M* HCl only 77 percent and in 6.0*M* HCl only 30 percent of the silver is exchanged in 5 min at 25°C. This effect of HCl is noted only as long as the silver concentration is so low that the solubility product of silver chloride is not exceeded in the tracer solution before immersion of the electrode. Higher concentrations of silver in hydrochloric acid were not investigated.

Table 1. Yields of radioactive silver from 1*M* HNO_3 by exchange procedure.

AgCl (mg)	Immersion time	Temp. (°C)	Recovery (%)
2	5 min	25	> 97
2	2 min	95	> 98
2	20 sec	95	50
0.3	5 min	25	85–90

A study of the decontamination afforded by this procedure showed a decontamination factor of 2×10^4 with 4-yr-old fission products and a factor of at least 10^4 with cadmium freshly bombarded with 7.8-Mev deuterons in the University of Michigan cyclotron. In addition, when carrier-free iodine was oxidized with permanganate and nitric acid, a decontamination of 10^4 was obtained. The advantages of this exchange method include its rapidity, its high decontamination in a single step, and simplicity of manipulation. Greater than 98-percent recovery is possible as long as the weight of solid inactive silver chloride is at least 50 times the weight of tracer silver in the solution.

This method should find use in radiochemical assay work when simplicity and speed are essential. It should be useful in characterization studies of short-lived silver activities in bombardment work and in the rapid determination of silver in fission products. It should also prove useful in the rapid preparation of high specific activity silver from irradiated materials such as palladium. It is readily adaptable to work with high levels of radiation when handling by remote control is required.

Experiments with this method of separation are continuing, and its applicability in other cases such as the exchange of iodide with silver iodide is being studied.

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References and Notes

1. A. Langer, *J. Chem. Phys.* **10**, 321 (1942).
2. This work was supported in part by the U.S. Atomic Energy Commission.
3. An inexpensive battery eliminator (Model BE-4), available from Heath Co., Benton Harbor, Mich., was used as a source of direct current.

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Prepottery, Lithic Complex from Sonora, Mexico

In the vicinity of Hermosillo, the capital of Sonora, Mexico, during the summer of 1953, I examined a group of seven campsites that represent a prepottery, lithic complex, very similar in type to the Cochise culture of southeastern Arizona. If, after more thorough study, a relationship is actually established between this complex and the prepottery cultures of the Southwest, then the southern range of Cochise influence will be greatly increased.

Topographically, the locale of these sites is predominantly a stretch of flat desert with little vegetation and no immediate evidence of a natural water supply. However, the Rio de Sonora flows approximately 1 to 2 mi to the south of the site area.

A majority of the stone artifacts recovered were fashioned by a percussion-flaking technique, and they show very limited evidence of retouching. These objects included (i) side and end scrapers, with the plano-convex form most common; (ii) crudely flaked knife blades; (iii) cobble choppers, the shape of which are similar to those of the southeastern California region; (iv) an abundance of large primary flakes, perhaps used as wedges for the opening of mussel shells; and (v) occasional projectile points. Three of the four projectile-point forms are comparable to those of the San Pedro stage of the Cochise, and the fourth bears a resemblance to the Pinto-Gypsum point of California. Slate and shale are the most commonly represented materials used in the manufacture of these stone implements, with basalt, jasper, quartz, and rhyolite porphyry also occurring. In addition, several one-handed bifaced manos, made from locally gathered granite rocks, were found. The surface survey disclosed no basin metates of the Cochise type.

The material recorded from this group of sites seems to correspond very favorably with the San Pedro stage of the Cochise culture (which in Arizona has been dated approximately 3000 to 500 B.C.), a period characterized by percussion-flaked chipped implements, but with the addition of a few pressure-flaked artifacts—particularly projectile points.

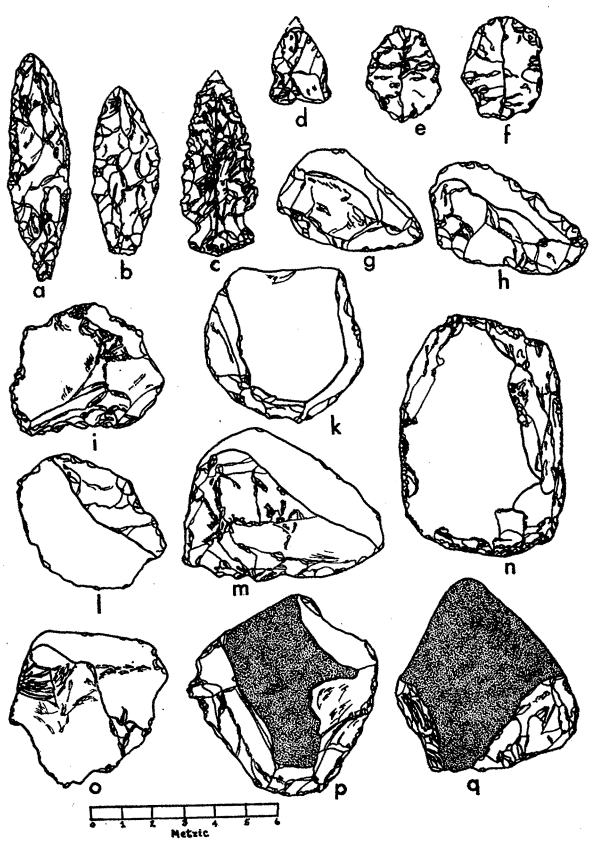

Fig. 1. Artifacts from the "Peralta" Cochise, Sonora: *a*, *b*, knife blades; *c*, *d*, projectile points; *e*, *f*, flake end scrapers; *g*, *h*, crude knife blades; *i*, *k*, plano-convex side scrapers; *m*, blunted side scraper; *l*, *o*, single flakes; *n*, side scraper-cutting edge; *p*, *q*, cobble end choppers.

This Sonoran manifestation very probably represents a local variation of an ancient cultural horizon of the Southwestern desert area. The material briefly described here has been designated tentatively as the "Peralta culture," possibly a Sonoran variant of the Arizona Cochise.

The artifacts will be deposited with the Biblioteca y Museo de Sonora in Hermosillo when the study is completed. This field survey was originally contracted with the Instituto Nacional de Antropologia e Historia of Mexico City, and was financed in part by the American Philosophical Society of Philadelphia (Penrose Fund) and the Kansas Academy of Science. Bill Young, of Springfield, Massachusetts, served in the capacity of field assistant.

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Selective Service Policy and Scientific Manpower

I am writing this note to my colleagues in scientific work in the United States because I have learned from conversations with members of the United States Congress that in general the members of the Congress have not been made aware of the critical nature of the current problem concerning recruitment, education, and utilization of specialized manpower in this country. It has become apparent that if the selective service legislation for the next 2 years is to recognize in a realistic way the long-term interests of the community in developing and utilizing specialized manpower, particularly in the sciences, the members of the Congress must receive more information from their constituents.

The American scientific community has an obligation to the public to call forcefully to the attention of the Congress the real hazard involved in our current policies. Existing general selective service and doctors' draft policies and practices are a serious threat to the future security and welfare of the country. Under present circumstances too few young men of ability are entering training programs in the fundamental sciences.

The present laws expire soon, and the Congress is now considering the terms of new acts to be in force for the next 2 years. This is therefore the time for scientists who have the interests of the country at heart to give their advice to their senators and representatives. Loyalty involves action as well as acquiescence. Democracy cannot work unless citizens participate in the processes of government; one of the essentials of participation is the sharing of information concerning problems of public policy with public officials. Some scientists, and other citizens, pretend to a virtuous obliviousness to public questions. They seem to enjoy a make-believe escape into an imaginary ivory tower of detachment that does not and cannot