

magnesium thus eliminated goes into the soluble olivine. The fact that the clintonite micas are almost invariably associated with spinel in nature, and frequently also with members of the olivine group, is very suggestive in this connection. The evidence of natural association and the evidence from the laboratory converge to one set of conclusions.

In the light of the foregoing statements the term "fractional analysis" practically defines itself. It is really an attempt at rational, as distinguished from empirical analysis; and it brings into the mineralogical laboratory the methods of the organic chemist. As yet, little more than a beginning has been made, but the field is promising and should yield a rich crop of valuable data. The researches are still in progress; and the results will be made public as rapidly as may be possible.

POST-MORTEM DIFFUSION OF ARSENIC, THE RESULT OF EMBALMING.

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James H. B——, a painter by trade, died on the morning of September 15th, 1891, after an illness, diagnosed by the attending physician as remittent fever.

Two hours after death the undertaker thrust an injecting needle into the abdomen of the deceased and injected a quantity of embalming fluid. The needle passed also above the diaphragm and the fluid was found on the autopsy to partly fill the thorax as well as the abdomen. This fluid contained about 100 grains arsenious oxide and ten grains zinc sulphate to the fluid ounce.

Coroner John Mathews took charge of the case because of rumors of foul play and ordered an autopsy. This was performed September 16th, by Dr. G. A. Lyons, twenty-four hours after the embalming. Parts of the viscera were removed. There was extensive peritonitis and there were pathological conditions that confirmed the

symptoms evidenced before death. The coroner judged, however, and rightly, that it would be wise to remove all doubt concerning alleged arsenical poisoning and the brain and other organs were brought me for toxicological analysis.

One-half the brain, 710 grms., was treated by the potassium chlorate and hydrochloric acid method for the detection of metallic poisons, and two milligrams of arsenious sulphide, equivalent to 1.6 milligrams arsenious oxide, extracted. The presence of arsenic was confirmed by other tests, especially that of Marsh.

The examination was continued and lead, copper and a minute quantity of zinc were also identified by their appropriate tests. The separation of these metals from the arsenic and from each other was quite difficult, and the detection of the zinc was particularly laborious, since the normal earthy phosphates and iron had to be separated, and, in this case, the lead showed a most harassing tendency to pass into analytical groups where it did not belong.

Had arsenic alone been found, a doubt would have at once arisen as to whether it was due to ante-mortem administration or post-mortem diffusion, and zinc was searched for with great care to clear up that point. The non-administration of arsenic in medicine, the very fluid condition of the blood, the injection of the embalming liquid so soon after death, the now well known fact that poisons such as these do diffuse through the tissues, even to parts remote from the point of injection,* and the absence of arsenic all lead to the conclusion that death was due to disease rather than poisoning.

While no other organs or parts of the body were analyzed it might be possible that arsenic had been absorbed during life along with lead and copper. It is well known, however, that arsenic is rapidly eliminated from the system while lead and copper are not. The man had an illness lasting from ten days to two weeks, during which time he did not work at his trade; any arsenic he might have obtained from such sources would, in all likelihood, have passed from him. The testimony of the attending physician and the history of the findings of the post-mortem agreed very closely,

* R. O. Doremus, 1859.

and the jury found a verdict of death due to peritonitis. The jury also took occasion to censure the zeal of undertakers in their over prompt use of embalming agents.

The discussions which arose some years since over post-mortem imbibition of arsenic, have been set at rest in great measure by the experiments made on the diffusion of this substance through the tissues of dead animals and the human cadaver. The brain has been selected as that organ least likely to absorb the poison after death, and therefore to yield the surest evidence of poisoning. The experiments of R. A. Witthaus, published in the *Researches of Loomis' Laboratory*, 1890, p. 38-52, show that arsenic diffuses to the brain when injected in such manner as to prevent its getting there by direct channels.

As previous experiments and papers on this topic are summarized in the article just quoted only a subsequent case is here cited.

Dr. F. A. Durell, Medical Examiner of Somerville, Mass., relates in the *Medical and Surgical Journal*, of Boston, 1890, Vol. CXXII., p. 544, the history of a case where the body was embalmed a few hours after death, and where Dr. Wm. B. Hills found arsenic in the stomach. The undertaker admitted, however, at the inquest, that he had poured some of the arsenical embalming fluid into the mouth, a fact he had previously denied. No analysis of the brain appears to have been made. The prosecution was abandoned. Dr. Durell is emphatic on the point of legislation restraining undertakers from using such measures to preserve the dead.

Since there is no form of murder more difficult to detect, more evasive of the just retribution of the law in the conviction of the criminal, every avenue of possible escape from discovery should be well guarded, and as no more ready means appears to exist to-day for the poisoner to complicate the chemical analysis, if not to render its results wholly valueless, to sow discord among experts and defeat in every way the meting out of justice, than to avail himself of the over zealous attentions of the funeral director, there should be concerted action on the part of all interested in this department of chemistry to form public opinion and secure the enactment of prohibitory laws.

The very speedy diffusion which seems to have taken place in

this particular instance leads me to lay the facts before you, for it shows how even the element of time which might have been a saving clause in favor of the chemist, is taken from him, and demands of us a most outspoken protest against a growing evil, which may frustrate the ends of justice in some cases, in others cause unjust suspicion to rest upon innocent parties.

PECULIAR PERFORATION OF ZINC RODS.

BY CHARLES E. MUNROE.

Through the courtesy of Asst. Eng. B. C. Bryan, U. S. N., of the U. S. Torpedo Boat "Cushing," I received a short time since some fragments of zinc rods which after exposure to the action of hot water in the wing-cylinders of the Cushing's boilers had become perforated throughout their entire length with a central canal.

These boilers are of the Thornycroft pattern and each consists substantially of a horizontal cylinder or "separator," placed in the upper part of the furnace, and two horizontal cylinders placed below in the wings of the furnace, each of these "wing-cylinders" being connected with the separator by a large number of steel "generating" tubes of small diameter which are bent in such shapes and so placed as to form a continuous arch over the grate, and yet spring from the tops of the wing-cylinders and enter the top of the separator. The wing-cylinders are also connected with the separator by means of pipes, known as the "down-comers," which are of larger diameters and have a more direct lead than the generating tubes.

The effect of this arrangement is, that when the boiler is filled with water to its normal level of about half-way up the separator and the fires are started, steam is rapidly generated in the generating tubes from which it rises with the water to the separator, where, by means of baffle plates, separation is effected, the steam passing to the engines and the water descending by the down-