the formula then being, $2H_2O.Fe_2O_3.2SiO_2.2H_2O$, or $H_4Fe^{III}{}_2Si_2O_9.2H_2O$. This formula requires the following composition:

SiO_2	34.23
Fe_2O_3	45.32
H_2O+	10.23
H_2O-	10.22
	100.00

THE CRYSTALLOGRAPHIC WORK OF GUSTAVUS HINRICHS

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The recent demise of Dr. Gustavus Detlef Hinrichs, at the ripe age of four score and ten years, removes from our midst a rather unique personage in American mineralogy. His chief investigations date half a century ago, so that those of the present generation know personally little of his accomplishments.

Hinrichs was a mathematical crystallographer, ranking with the distinguished Haidinger of Vienna, and the great Klein of Berlin, and the only one this country ever produced. A pioneer of pioneers in what we now know as physical chemistry, his researches in this field were so many, so fundamental and so brilliant that one loses sight of the fact that he also did so much creditable work in mineralogy, meteorology and geology that in each of these fields his name will be long remembered.

Hinrichs' work on the structure of crystals had an unusual and especially broad prospect and an illuminating bearing on our modern concept of the atom. He early sought to show that the chemical nature of a substance found visible expression in its crystal form. His especial mission was the mathematical and crystallographic demonstration of the unity of matter, the foundation of which he designated as *Pantogen*.

Hinrichs was not so widely known among American scientists as he should have been. Most of his numerous publications were issued in Europe in languages other than English. This was due no doubt in large measure to early rebuff which he received in this country; and with a sensitive and high strung soul such as his the affair rankled in his breast to his dying day. In order to get his

new discoveries before the scientific public with as much expedition as possible, so that they might not be anticipated and their priority possibly questioned on account of the delay, he prepared a clear, concise summary of his views and sent it to the American Journal of Science where it was rejected rather unceremoniously. Not a single scientific journal or learned society would sponcer or publish this first brief outline.

Relation of the circumstances and the difficulties of getting his new thought before the world is curious commentary on our boasted progressiveness, but which is in reality our ataxic conservatism, a proneness every whit as repressive today as it was then. Long years afterwards Prof. J. D. Dana, of Yale University, editor of the American Journal of Science, at that time the foremost journal of its kind, seeing the great consideration with which the Hinrichs' memoirs were received in Europe, and recalling in some way his own strange gaucherie, wrote a long letter of apology for refusing him admission to the pages of the Journal, and excused himself on the grounds that he (Hinrichs) had been entirely too far ahead of the times.

At length despairing of having the memoir appear under the aegis of any American scientific society and not wishing to run risk of being supplanted through delay, Doctor Hinrichs prepared a concise résumé in French, in clear, bold characters, had it lithographed in Davenport, Iowa, and published it thus privately, in which form it was widely distributed. In marked contrast to its cold reception in this country it was given warmest acceptance in all the capitals of Europe, and especially in Paris, where the keen French mind was not slow in grasping the far-reaching significance of so novel and brilliant conception. So eulogistic were some of the members of the French Academy of Science that he was soon led to present his views more formally before that Institute. This summary was the first of a long series of memoirs, upwards of 60 in number, that were read before that body and printed in the *Comptes Rendus;* while more than a hundred others appeared in the *Moniteur Scientifique* of Paris. Elsewhere, in Austria, Denmark, Germany, and England, learned societies hastened to do him homage by electing him to membership.

Scientific achievements other than those in physical chemistry were attained chiefly while Professor Hinrichs was still a resident of Iowa, and while he held the chair of physical sciences in the State University. Although an expert mineralogist he made few contributions along the usual descriptive lines, except on the meteorites. On this last mentioned topic he went into considerable detail in an account of the great Iowa meteor of February 12, 1875, which was one of the most brilliant and notable phenomena of the kind ever witnessed in modern times, and which illuminated not only the whole State of Iowa, but the adjacent parts of Missouri, Illinois, Wisconsin and Minnesota. It was afterwards christened the Amana Fall; and the stones were distributed to many of the principal museums of the world. Accounts of this Fall were read before the French Academy of Sciences, attracting attention the world over.

Thoroughly original and important was Hinrichs' work on the crystallographic side of mineralogy. As a strictly mathematical crystallographer he belongs to the special coterie of the most distinguished men of this class. Notwithstanding the fact that it was among his first published works, his "Principles of Pure Crystallography" was a singularly erudite performance on the theoretical aspects of the subject; and the "Introduction to Crystallographic Chemistry" was incorporated in "Microscopical Chemical Analysis," a volume published by his son, Carl G., in 1894. More technical papers, chiefly read before the Vienna Academy of Sciences and published in the *Sitzungsberichte*, "On the Crystal Structure of Quartz," "the Statics of Crystal Symmetry," the "Chemico-Physical Reality of Rhombo-Tesseral Forms," etc., were thoroughly mathematical in treatment; but they reflected well the bent of his mind at this time, and the transcendent scope of some of his musings.

Partly through mathematical calculations, partly through results of chemical analyses, and partly through crystallographic construction of the atom Doctor Hinrichs not only demonstrated the unity of matter, but he showed that he could, from the primitive "atom," which he designated *Panatom*, build up any element, and further, if he could be supplied with a proper force, he could transform one element into another.

Possible or actual transmutation of base metal into precious metal is not really the important part of Hinrichs' researches, experiments and calculations. Discovery of the Philosopher's Stone is, of course, merely the romantic phase, the one that most appeals to an unthinking public. The modern and practical value is a far broader prospect. This is the establishment of the unity of matter. Surely this is making crystallography lift the veil of darkness and give insight into the nature of matter far beyond what mineralogists are accustomed to witness.

The pen of Doctor Hinrichs was as busy as his mind. The procession of his intellectual progeny spanned an interval of 75 years. Nearly half a hundred ponderous tomes attested the vigor and magnitude of his efforts and his tireless industry. Several hundreds of memoirs were published in the transactions of the learned societies. A majority of these appeared in Europe and in half a dozen languages. The 160 communications printed in Paris were already noted. Others were included in the publications of the scientific academies of Vienna, Berlin and Copenhagen. The complete bibliography of his works constituted one of the most imposing arrays of accomplishments ever produced in this country.

From a geological angle, a rather full biographical sketch of Doctor Hinrichs appeared in a recent volume of the Pan-American Geologist; and a complete bibliography of his writings in the several fields which he occupied will be printed in the forthcoming Proceedings of the Iowa Academy of Sciences.

FAMOUS MINERAL LOCALITIES: FURNACE CREEK, DEATH VALLEY

W. F. Foshag,[1] *United States National Museum*

The borax mines of Furnace Creek in the Death Valley region have been active for a number of years and are still the principal producers of borax in the United States. They are little visited by mineralogists, partly because of their comparative inaccessibility and partly because of the Pacific Coast Borax Company's policy to exclude all visitors and to allow no specimens to leave the mines.

[1] Published by permission of the Secretary of the Smithsonian Institution.