THE HISTORY OF THE TITANIUM DIVISION

Titanox Pigments
Early History and Development

The element Titanium which forms the base of Titanox pigments, was discovered in 1791 by the Rev. William Gregor, a priest in the parish of Menachan in Cornwall, England. It occurred in the form of a black sand composed of oxides of iron and an unknown metal. This sand was christened Menakanite. No further attention was paid to the discovery until 1795 when M. H. Klaproth, in Austria, extracted and identified from a mineral now called Rutile, the element previously discovered by Gregor. To Klaproth is given the credit of naming the mineral "Titanic Earth", having reference to the mythological Titans, the first sons of the earth, from which the name "Titanium" was derived. Subsequently, extensive deposits of a similar mineral were found in the Ilmen Mountains of Russia, and the name Ilmenite superseded Menakanite as the group name for Titanium bearing ores. Later deposits were found in Norway, Canada, India, North Africa, Madagascar, Brazel and many parts of the United States.

About 1860 a British company obtained a mining concession in Norway and attempted to smelt the titanium from ore at a plant in England. Due to many difficulties met in the handling of the ore, they were soon forced into liquidation. One of the partners of this venture, J. W. Ryland, brought a boatload of the crude titanium ore to Birmingham about 1869, reduced it to a fine powder, heated it to remove the moisture, cooled it and ground it into paint with a vehicle such as a mixture of boiled oil and turpentine. In 1870 John Overton of Louisville, Ky., patented an anti-fouling composition prepared by reducing rutile to a fine powder and grinding it in a bituminous composition.

These primitive applications marked the first attempts to utilize titanium as a paint pigment, but their instigators appear to have missed entirely any conception of the idea of separating the oxide in a pure state - a development that, later one, was to prove so important.

Strangely enough titanium occupies a paradoxical position in that it was, and, to a considerable extent, still is considered a chemical curiosity and a rare element in spite of the fact that, actually, it is the ninth most abundant of the eighty-three elements which make up the lithosphere. It is exceeded in abundance only by

oxygen, silicon, aluminum, iron, calcium, sodium, potassium and magnesium. Lead and zinc, the two metals which serve as the bases for the other major opaque white pigments, are well known and are thought of as occurring in abundance, but if tin, antimoney, nickel and copper were added to the list, the combined world supply of these six well known elements would be exceeded by titanium.

Development in America by the Titanium Alloy Mfg. Co., and the Titanium Pigment Company

About 1870 a young French chemist, Dr. A. J. Rossi, came to America and was engaged in a blast furnace operation at Boonton, N. J., where titaniferous ores were successfully smelted into pig iron. During this experience he became very much interested in the subject of titanium, especially as it occurred in iron ores.

The McIntyre Iron Company in previous years had operated a blast furnace in the Adirondack Mountains for the reduction of Titanium bearing ores. Mr. James McNaughton, who controlled the large acreage on which this enterprise was conducted, was cognizant of the richness and extent of the titaniferous ores deposits here available and of the doubt expressed by blast furnace operators regarding the possibilities of the use of such ore in furnace practice. He secured the services of Dr. Rossi as the only individual in the country who knew anything about the practical smelting of such ores. About 1890, with Dr. Rossi and several friends, he organized a syndicate and erected a very small blast furnace in Buffalo, where titaniferous ores were smelted in various proportions. Dr. Rossi secured patents on the processes of smelting such ores and also on the manufacturing of various titanium alloys. Shortly after this date Mr. McNaughton passed away and his affairs were taken over by two nephews in Albany, J. McNaughton Thompson and Andrew Thompson. They in turn enlisted the interest and support of William T. Meredith & Company, an investment house in New York City, and, in 1904, William F. Meredith and Joseph D. Meredith became actively engaged in the enterprise. With their assistance the Titanium Alloy Mfg. Co. was incorporated in 1906 and a plant was built at Niagara Falls, N. Y., for the production of ferrocarbon-titanium, an alloy used in the purifying and scavenging of steel.

In 1912 Mr. L. E. Barton became affiliated with the Titanium Alloy Mfg. Co. and joined Dr. Rossi in a systematic program of research on the pigment possibilities of titanium. As far back as 1908 Dr. Rossi had separated an impure titanium oxide and had proved its unusual opacity as a pigment by mixing it with salad oil

and applying the combination as a paint. This was probably the first definite conception of the use of Titanium oxide as a white pigment. In their continued work Rossi and Barton developed a method of separating titanium oxide from rutile and ilmenite.

About 1913 two engineers, H. H. Buckman and George A. Pritchard, who had been making an investigation of Florida sand deposits, brought to the attention of the Titanium Alloy Mfg. Co. the titaniferous sands of Northern Florida, and these deposits became for a time the principal source of titanium ore for use in the Niagara Falls operation.

Further research and development by Rossi and Barton demonstrated the practicability and value of Titanium Dioxide as a white pigment possessed of unique qualities and outstanding merit, and the composite types of Titanium pigments were conceived and developed by them in their continued studies.

As an outgrowth of their efforts the Titanium Pigment Company was incorporated in 1916 and a factory built at Niagara Falls for the production of titanium pigments. The officers of this newly incorporated venture were William F. Meredith, President; Andrew Thompson, Vice-President; and Joseph D. Meredith, Treasurer. Operation of the factory was curtailed by restrictions imposed by the Government in connection with the distribution and use of power during the war, so it was not until 1918, after the signing of the armistice, that commercial production of titanium pigments was begun.

After an exhaustive investigation which convinced them of the great possibilities of titanium in the pigment field, the National Lead Company purchased a substanial interest in the Titanium Pigment Company in 1920. They continued as partners in the enterprise until late in 1932, when they acquired the entire stock of the subsidiary company. In October, 1936, the Titanium Pigment Company, Inc., was dissolved, and the manufacturing interests, property, and stocks were taken over by the National Lead Company - Titanium Division. Sole selling rights for Titanox pigments were vested in a new company, The Titanium Pigment Corporation.

About 1922 the interests of Buckman and Pritchard, Inc. were acquired by the Titanium Pigment Co., who thus became the outright owners of the Florida properties. However, it became more expedient and economical to obtain titanium ores from other sources and the Florida operation was suspended, the equipment dismantled and moved to other localities where it could be put to advantageous use. The property in Florida, lying on the east coast about twenty-five miles below Jacksonville, has been developed into a very attractive resort known as the Ponte Vedra Country Club.

In the experimental and development work of Rossi and Barton, four types of titanium pigments were produced as follows:

Titanox-A - The Dioxide of Titanium
Titanox-BX - Consisting of 16% Titanium Dioxide precipitated on Blanc Fixe.
Titanox-BXX - Consisting of 25% Titanium Dioxide precipitated on Blanc Fixe.
Titanox-C - Consisting of Titanium Dioxide precipitated on Calcium Sulphate.

Titanox-BX did not prove to be of commercial interest and was soon discontinued. Later developments, in some of which Mr. Barton participated, resulted in other pigments as follows:

Titanox-L - Wherein Titanium Dioxide and Lead Oxide are fused to form Lead Titanate.
Titanox-B-30 - Consisting of 30% Titanium Dioxide precipitated on Blanc Fixe.
Titanox-M - Consisting of 30% Titanium Dioxide admixed with Magnesium Silicate.

The commercial operation at Niagara Falls at the start was confined entirely to the production of Titanox BXX, later known as Titanox-B (Titanium Barium Pigment). This factory was of limited tonnage capacity and the interest in Titanox pigments increased so rapidly that in 1922 it became necessary to make some importations from Europe in order to supply the domestic demand.

The Niagara Falls plant thus having proved inadequate to supply the growing demand for tonnage, a second and larger factory was begun in St. Louis, Missouri, in 1923. This plant was completed and put into operation in the same year for the production of Titanox-B.

In 1925 the Niagara Falls plant began the manufacture of Titanox-C (Titanium Calcium Pigment), the production of which was urged by certain paint chemists who were familiar with it as an experimental product and who recognized its potential value as a pigment for flat wall paints.

In 1925, as a result of continued research by Mr. Barton and Mr. L. W. Ryan, who had become associated with him at Niagara Falls, a grade of Titanox-A (Titanium Dioxide) much superior to anything previously made, was developed and commercial production was started at that plant.

In 1928 the production of Titanox-C was transferred to the St. Louis factory for purposes of economy. This permitted the Niagara Falls factory to concentrate entirely on Titanox-A until 1931, when, as another economical move, production of this pigment also was transferred to the St. Louis factory.

Shortly thereafter the continuing increase in the popularity of and the demand for Titanox pigments indicated the necessity for a further expansion of manufacturing facilities. Accordingly a plot of sixty-seven acres was purchased in the township of Sayreville, N. J., and ground was broken in 1934 for a large new factory, the first manufacturing unit of which was placed in operation in May, 1935. Since then two additional manufacturing units have been completed and placed in operation, and there are indications that these may soon have to be augmented.

The Niagara Falls plant, which had been idle since 1931, was again started on the production of Titanox-B in March, 1934, and continued manufacturing for two years, when it was finally closed, the equipment partially dismantled, and the factory sold in 1937 to The Titanium Alloy Mfg. Co.

EUROPEAN DEVELOPMENT BY THE TITAN COMPANY A/S

One of the most extensive and readily worked source of ilmenite is on the coast of Norway. This deposit was first exploited about 1860 by an English Company which obtained a mining concession and imported the ore into England for metallurgical use. Nothing further was done with this deposit until about 1908 when a Government Commission was appointed to investigate the available iron ores of Norway, and attention was again focused on this titaniferous ore deposit.

Professor Farup, one of the members of the Commission, with Dr. Gustav Jebsen conducted a joint investigation on the smelting of these ores and came to realize the difficulty of such treatment. Thereupon other methods of utilizing the ores were sought, and this research led to the development of white titanium pigments. The first product, made from ilmenite, was a reddish yellow pigment of great hiding power known as Titanium Ochre. This was not attractive from the standpoint of either color or cost, so little was done with it. However, it resulted in the idea of extracing titanium oxide in a pure state and introducing it as a pigment. This was accomplished as evidenced by a Norwegian patent granted in October, 1912, to Dr. Jebsen and production of the composite titanium pigments was begun in Fredrikstad, almost simultaneously with the initial production of similar pigments at Niagara Falls. To facilitate the development of

the pigments, the American and Norwegian groups of workers, who had along worked independently, came together in 1920 through the establishment of relations including a cross licensing of patents, which enabled them to progress more rapidly through a mutual interchange of experience and ideas.

In 1927, the relationship thus established was made closer through the acceptance by The National Lead Company of an offer for the sale to it of a controlling interest in the Norwegian company, Titan Co. A/S, and in its French affiliate, Societe Industrielle du Titane. Later in the same year, with a view to a wider exploitation of the European and Asiatic fields, an arrangement was concluded between Titan Co. A/S and I. G. Farbenindustrie A. G., leaders in the German chemical industry, for the formation of a jointly owned German Company, Titangescellschaft m.b. H.; the construction by the latter of a plant at Leverkusen to supersede the Fredrikstad plant and supply the requirements of the European and Asiatic markets, and the sale of the resultant product by each interest in certain specified territory. The general management of the European interests of National Lead Company thus acquired was placed in the hands of Dr. Jebsen, who also retained his original interest in the Norwegian company.

Early in 1930, for the more convenient administration of the joint interests of National Lead Company and of Dr. Jebsen, a holding company was formed under the laws of Delaware, known as Titan Company, Inc., which acquired all the foreign interests of the Norwegian Company and the stock interest in the French Company formerly held by National Lead Company.

The pigments made by Titangescellschaft m. b. H. are sold in Denmark, Estonia, Finland, Iceland, Latonia, Lithuania, Norway, Siam, and Sweden, by Titan Co. A/S, Fredrikstad, Norway; in Belgium and Holland by Societe Belge du Titane, Brussels, Belgium; in France by Societe Industrielle du Titane, Paris; and in other countries of the eastern hemisphere (excepting British and Japanese possessions) by I. G. Farbenindustrie A. G., or their agents.

Early in 1933 a further step was taken in the development of the European industry by the organization of the British Titan Products Company, Ltd., under the joint ownership of Titan Company, Inc., and various British interests, including Imperial Chemical Industries, Ltd., Imperial Smelting Corporation, Ltd., and Goodlass Wall and Lead Industries, Ltd., for the manufacture and sale of titanium products throughout the British Empire (except Canada and other territory in or adjacent to North America).

A manufacturing plant was constructed by the British company at Billingham, Stockton-on-Tees, County Durham, and production

of titanium pigments began in July, 1934. R. W. Greeff and Co., Ltd., of London, act as selling agent for the British Isles, and British Titan Products Co., Ltd., are responsible for sales in the rest of the United Kingdon except Canada.

In 1936 Titan Company, Ltd., with certain of its European associates, concluded arrangements with Japanese interests for the joint development of the market for titanium pigments in the territory comprised by the Empire of Japan and its colonies and leased and mandated territories as then constituted, including Manchoukuo. The arrangements provided for the organization of a new corporation to supply that market under the name of Titan Kogyo Kabushiki Kaisha, of Kobe, jointly owned by Doitsu Senryo Goemi Kaisha (representing Titan Company, Inc. and its European associates) and Kokusan Kogyo Kabushiki (representing the Japanese interests), both of Kobe, Japan; and for the exchange of patent licenses between the various parties in interest for their respective territories. Pursuant to these arrangements Titan Kogyo has built a factory in Japan from which the demand for titanium compounds in the Japanese territory is now being supplied.

Late in 1936, the National Lead Company arranged for the sale of its rights to the titanium business in Canada to Canadian Industries, Limited, and in payment, therefor, accepted an interest in a new organization known as Canadian Titanium Pigments, Limited.

This organization, with headquarters at Montreal, took over the sale of titanium pigments in Canada on January 1st, 1937, continuing with the Titanium Pigment Corporation and British Titan Products Company, Ltd., as their temporary sources of supply. A suitable site will be selected and the building of a plant for the production of titanium pigments in Canada will be started in the near future.