China-Alfred Connections (1924-1961)

Based on the Contributions of

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July 22, 2005

[Issued on the 100th anniversary of W.J. Sutton's Birth]
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Introduction

The New York State College of Ceramics at Alfred University has had many close ties with the Chinese ceramic industry during the past 85 years. One important earlier connection was through the efforts of Dr. Willard J. Sutton, who was a Professor of Chemistry from 1924 to 1941 at the Fukien Christian University in Fukien Province, China. During his early years at FCU, he became keenly interested in the history and manufacture of porcelain and pottery in southeastern China, and introduced a ceramics curriculum in 1928. With the outbreak of the Sino-Japanese War, he and his family moved to the US. He was a Professor of Ceramic Engineering at Alfred University from late 1941 to 1961.

This report highlights some of his activities and contributions to the teaching, training and inspiring of students in China and in the US. He felt that teaching the fundamentals of chemistry was of prime concern, but that it should be tempered and applied to practical applications. He also visited and reported on visits to the ancient porcelain center in Tehwa and other pottery industries in the Province.

Fukien (Fujian) Province (1900-1920) [Note: the present names are Italicized]

Fukien Province is a little smaller than New York State and is located in southeastern China. During the early 1900's, the Province was beset with civil strife, local wars, banditry, and disease. The people were cut off by natural barriers from the rest of China, and were divided into several smaller districts. There were also language barriers, because different dialects were spoken in the various districts. The citizens of Foochow [Fuzhou], the largest city in the Province, could not understand the spoken word of the people from Amoy [Xiamen], the second largest city. This all contributed to a Province that was badly backwards in industrialization, transportation, and communication, when compared to nearby Provinces in China. All this was to change during the next 40 years.

During the mid 1800's, Yankee Tea Clippers made Foochow one of their principal ports of call. Millions of pounds of tea were shipped annually from Foochow. In addition to tea, the Province was rich in silk, rice, oranges, pomelos, and other fruits, vegetables, timber, tong oil, camphor and many minerals and clays.
Fukien Christian University [FCU] (1915-1942)

In 1915, a group of educators from different Protestant Denominations recognized a critical need to teach and train future leaders in Fukien Province. While there were already several middle schools, there was no institution of higher education. Thus FCU was founded, and the first classes for 61 students were held in Foochow in 1916.

In 1918, the University was incorporated by the Board of Regents of the State of New York and was chartered to grant a B.A. Degree. The Board of Directors was located in New York City, although a local Board administered the daily activities. Shortly thereafter, The Rockefeller Foundation, through its China Medical Board, granted a considerable fund to aid in the establishment of pre-medical sciences. This aid enabled the University to offer good science courses, and was largely responsible for many of the fine buildings, books, and equipment, as well as providing for six science teachers for a number of years.

In 1920, fifty acres were purchased along the banks of the Min River and on the knoll of Drum (Kushan) Mountain. The construction of several buildings and classrooms was started. This location was about 5 miles downriver from Foochow and 20 miles upriver from the sea (Pagoda Point). The land with hills, canyons, and level fields was an ideal place for the University; it proved to be one of the most beautiful, quiet, and picturesque settings in China, and was away from the crowded city of Foochow. In 1922, the first classes were held on the FCU campus.

The University was divided into three schools:

1. School of Fine Arts. Chinese Literature, English Literature, History, and Education
2. School of Sciences. Biology, Chemistry [organic, analytical, physical chemistry, and later, ceramics], Math and Physics, and Pre-med.
3. School of Agriculture. Agronomy, Horticulture, Rural Economics, Rural Extension Services

In 1927, Dr. Ching-Jun Lin was the first Chinese to become President of FCU. He was instrumental in registering the University with the Fukien Government Education Department. This resulted in close interactions with the Government, which also became a good source of future support and funding.

By 1928, there were 21 pre-med students and 120 science students. This was also a period of growth and expansion with the addition of new buildings. In 1930, there were 51 on the teaching staff; 33 with bachelor degrees and 18 with advanced degrees. The Hall of Science and the Hall of the Arts were two of the major building constructed with lecture rooms, laboratories, an auditorium, and a library with over 12,000 Chinese volumes and 9,000 English volumes. Photographs in Insert 1.1, show views of the FCU campus, buildings and members of the 1931 faculty, and those in Insert 1.2, show more views of the campus, the chemistry lab, and pottery made by the students.
During the 1930’s, the University, while small, had some of the best-equipped laboratories and teaching facilities in China. The campus grew to 160 acres, with over 20 buildings. Twenty-percent of its graduates went on to advanced degrees in China and abroad, and many went into medicine, teaching, agriculture, industry and government. Twenty-percent of the students were women by the end of the decade.

The contributions of FCU to the Province and other institutions in China were well recognized. This was also a period where the Province enjoyed a large amount of capital flowing back, making for cultural rebirth and growth. Fukien Province was becoming one of the most progressive provinces of the time. The people of Fukien possessed a high degree of intelligence, enterprise and determination.

In 1937, there were 169 students enrolled at FCU. Japan started to blockade (without declaring war) the seaports of China, including the one at Pagoda Point. In June of 1938, the faculty, laboratory equipment, and classes were moved to a campus located in Shaowu, 250 miles upriver from Foochow. Over 9 truckloads of books were transported over difficult terrain to the new location.

During late 1939, the Japanese had taken over the coast of South China. They started to bomb Foochow in 1940. Foochow fell to the Japanese in July of 1941. An American flag flying over the FCU Campus entrance kept the Japanese temporarily from occupying the University. However, the Japanese eventually took over the Campus in 1942. FCU was abandoned and was never reopened after WW II.

During 1941-1942, there were 403 students and a faculty of 60 at Shaowu, and by 1943 the number of students had grown to 1200. This growth was largely due to Chinese students coming from threatened institutions, including those in Shanghai.

**FCU and Prof. Willard J. Sutton (1924-1941)**

Prof. Willard J. Sutton received a BS degree in Ceramic Engineering from Alfred University in 1917. During WW I in 1917-1919, he served in the US Field Artillery HQ Detachment in France. After the War, he attended the University of Pittsburgh, and studied under Professor Alexander Silverman. (The Silverman Glass Collection is in the Alfred University Art Museum). In 1923, Prof. Sutton received a PhD degree in Inorganic Chemistry.

In 1924, Prof. Willard J. Sutton joined the FCU Chemistry Department, and later became Chairman. His wife, Ellen Holmes Sutton was a medical doctor, and was with him on the FCU Staff Dr. The photo in Insert 1.2 shows Dr. Ellen Sutton treating a patient who was brought to her on a sedan chair. Also, in this insert is a photo of Prof. Sutton at a later date in the pottery laboratory at Alfred.

In addition to teaching courses in chemistry, he established a ceramics laboratory, with testing and processing facilities in 1928. Because of the famous porcelains produced in
Tehua, an ancient porcelain center, it was inevitable that the white clays of the Province were brought to the laboratory for testing. In 1933, Prof. Sutton authored a paper entitled, "Physical Chemistry in Porcelain Manufacture", which was published in the Lingnan Science Journal-Special Supplement, Lingnan University, Canton (Guangzhou) China.

The ceramics curriculum focused primarily on clay and clay working to meet the pottery and tile industry needs. He introduced microscopy and chemical analyses of the clay minerals and rocks, porcelain, and glazes. Four kilns with different firing capacities were designed and built. Several students graduated with BA theses in ceramics. Many of these theses were based on characterizing, testing, and evaluating dozens of clay deposits and other ceramic minerals from throughout the Province. Through processing, beneficiation, and other treatments and additives, the clays were upgraded for improved applications in the pottery, brick, tile, and building industries. The students were also introduced to the casting of clay slips in plaster molds and to the turning of plastic clay bodies on the pottery wheel. They learned how to further process, glaze and fire the shapes to the final product. (Examples of fired shapes are shown in Insert 1,2).

Notable contributions were made in the batch formulation of a variety of pottery clays, including the development of excellent, translucent, cone 14 (1400°C) hard porcelains, and several over- and under-glaze formulations of a variety of colors. Many of the graduating students went on to help modernize and introduce significant processing improvements in the ceramic industry.

Prof. Sutton left China in 1937 with his wife and four children for Alfred N.Y. The impending Japanese invasion made it necessary for the family to leave China. However, at the urgent request of President Ching-Jun Lin, Prof. Sutton returned to FCU in 1938 to help in the move to Shaowu and also be the Caretaker and Business Manager of FCU.

During 1939, the Japanese had blockaded the coast of southern China. In 1940, Prof. Sutton could observe the bombing of Foochow from the FCU Campus. The Japanese planes also strafed the river launches and vehicles on the road leading to Foochow, so that any travel had to be done under nightfall.

Prof. Sutton remained at FCU as Caretaker during 1939-1941, although he taught a course in physical chemistry at Shaowu in 1939. However, he managed to continue studies on the making and firing of clay and glaze bodies during this period, with the help of a Chinese coolie “technician”. Only as few of the personnel of the FCU Campus remained.

In February of 1941, he left FCU over a mountain route to Shanghai and then on to the US. Unfortunately, he had to leave behind 16 years of household goods and most of his Chinese collection of pottery and art objects.
Visits to The Tehwa (Dehua) Porcelain Center (1935 and 1938)

Tehwa is a small city, which is located in the mountains and wilds of central Fukien Province and is over 200 miles from Foochow. It is comprised of several smaller villages, in which the families provide the potters and support for the production of porcelain ware. Being located in a very remote region, Tehwa had been inaccessible to Western visitors for several centuries. Its true origin and history are still not well documented. Hobson (in 1915) indicated that a missionary with no technical training had visited Tehwa in 1890, and described the location. The first Western men to visit Tehwa with scientific and archaeological skills were Profs. Willard J. Sutton and Malcolm F. Farley of FCU.

The Tehwa Porcelain Center was famous for the production of Blanc-de-Chine ware during the Ming (1368-1644 AD) and Ching (Qing) (1644-1912 AD) Dynasties. The porcelain was noted for its absolute beauty, perfection, harmony and translucency. The Chinese potters, having learned early to fire pottery to stoneware temperatures (1150°-1300°C), tried the white clays found in their mountains. Five centuries ago, they developed the kilns, refractories and firing conditions that transformed the white (kaolin) clay into porcelain.

Tehwa was the second most famous ancient pottery center in China after Ching-Te-Chen (Jing-de-zhen). Ching-Te-Chen, which is the foremost pottery center in China, had received the patronage of most of the emperors for over 1500 years. Tehwa, on the other hand, succeeded without much outside help to produce its famous ware.

In spite of its remoteness, the Tehua porcelains were sent by ship and caravan to far away countries beginning in the 14th century. The Egyptians and Turks knew about the porcelain long before it reached Europe. The European pottery at that time was markedly inferior. The arrival of the Blanc-de-Chine porcelain in Europe had a tremendous impact, and laid the foundations of modern ceramics in the Western Countries. It wasn’t until the early eighteenth century that the Europeans were able to produce their own fully dense, white porcelains.

By 1935, The Fukien Government had eliminated the bandits and revolutionaries that prevented travel to the Tehwa area. The Government also built new roads into that region, so that it was possible in May 1935 for a group, led by two FCU Professors, W. J. Sutton and Malcolm F. Farley, to make a 3-day bus trip to visit the Tehwa Porcelain Center. The purpose was to photograph and document the current manufacturing methods used to make the porcelain ware. In Insert 2.1, 2.2, and 2.3, photos of some of the manufacturing process steps are shown, from the mining, grinding, and washing of the clays, to the turning of shapes on a wheel or the molding of figurines from the clay paste, to the drying, glazing, and firing, and finally to ‘shipping’ the products.

Perhaps one of the most remarkable achievements of the Tehwa potters was their ability to fire technically superb porcelain figurines and other objects in such large quantities.
They had developed the use of highly efficient large “tunnel-kilns”, which used pinewood to fire the ware in saggers under slightly reducing conditions to cone 14 (1400°C). This produced the white and slightly blue to cream colored porcelain (depending on the impurities in the clay). After one of Prof. Sutton’s presentations on the Tehwa visit before the American Ceramic Society in 1938, Philip Dressler (of Swindell-Dressler Kilns) commented on the fact that he was proud of his modern tunnel kilns in the US, but then stated that the Chinese had beaten him by 500 years.

Prof. Sutton published the results of his visit to Tehwa in a 1938 Bulletin of the American Ceramic Society (Acers), a copy of which is included in Insert 3.

In 1938, Governor Chen of Fukien Province asked Prof. Sutton to revisit Tehwa in order to make improvements in the manufacturing process. During the Japanese blockade, the quality of the Tehwa pottery had suffered. In December 1938, Prof. Sutton visited the Porcelain Center. He noted areas for improvement and made several recommendations as a result of this visit. One of Prof. Sutton’s students, Si-wen Huang, had been sent in 1937 to set up a ceramics experiment station at Tehwa. He also introduced the slip casting process, which was new to the Tehwa potters. Unfortunately, by mid 1939, the Japanese had blockaded all the Chinese ports. Manufacturing in Tehwa was severely cut back, and the experiment station was closed in late 1939.

A 12-page report plus 20 photographs on the Tehwa Porcelain Center was written by Prof. Sutton and translated into Chinese. The cover and first page of this report and a map of Tehwa are shown in Insert 4. The report was sent on to Governor Chen in Foochow. Unfortunately, in 1939, a Japanese spy had Chen’s residence under surveillance, and soon after it was bombed. Luckily, Governor Chen was not present, but the report must have been lost or destroyed, since Prof. Sutton never received a reply from the Governor. However, D.P. Nyien of the Fukien Provincial Government Reconstruction Bureau received a copy of the report. He sent a letter of March 30, 1939 to Prof. Sutton expressing gratitude for the services and recommendations provided to the Tehwa porcelain center. A copy of the letter is shown in Insert 5.

Ceramic Archaeology in Fukien Province (1922-1939)

During their early days at FCU, Professors Willard J. Sutton and Malcolm F. Farley became very interested in the ancient history of ceramics and the arts of Fukien Province. Mr. Farley was a Professor of English and Head of the Department of Western Languages and Literature. He became an avid student of the ancient history of the Province, with special interest in the language and poetry, paintings, ceramics and other artifacts. He amassed a sizeable collection of art, ceramic and bronze museum objects. Over the years, he became recognized as an important scholar on the history and culture of Southeast Asia.

Prof. Farley became one of the first archaeologists in China to realize the importance of ancient kiln sites. Work took him throughout Fukien province, exploring, discovering and
uncovering forgotten pottery centers. He was able to identify the source and period of thousands of sherds and pottery pieces, and issued several publications on the subject.

His interest in Chinese ceramics also led to a study of the great medieval ceramic trade between China and far distant lands. In the late 1920’s, he received a grant from the Harvard-Yenching Institute and the American Council of Learned Societies to explore and document the evidence of commerce between China and the Near East. He followed and traced the trade in Chinese porcelain and positively identified Tehwa porcelain pieces in the ground in Persia (Basra), in Turkey (Campus of Roberts College near Istanbul), and in the soil of Egyptian villages.

Prof. Farley amassed one of the World’s largest collections of ancient and modern Tehwa porcelain. His collection was placed in the FCU campus museum. During his visit to Tehwa in 1935, he came across cuts in two banks along a new road, which had been opened during a recent building project. These cuts had uncovered ancient Tehwa kiln sites. He identified several pieces that were many centuries old, and noted that they were not in the porcelains of current production. His examination of one of these sites is shown in Insert 2.1.

Prof. Farley published several articles on Tehwa. One included “Some Well Known and Some Little-Known Facts About Te-Hua Through the Centuries”, which was published in the Hsieh Ta Journal, FCU, Foochow, China, Vol IV, Nov., 1936. A copy of this publication is shown in Insert 6.

In 1934, tombs of the Han Dynasty (206 BC–220 AD) were uncovered at a twenty-foot depth, during the construction of a new hospital near Foochow. These were brick lined tombs 7 feet long and 4 feet wide with arched roofs. They were uncovered still in tact. Profs. Sutton and Farley found several pieces of pottery, including a 20-inch tall grain jar with a green iron-lead glaze. Some bronze and other artifacts were found also.

Pottery from the Sung Dynasty (960-1279 AD) was found by Prof. Sutton in the mountains of North Central Fukien Province near Kien-Yang and Kien-Ning (Chien-An). This included several tea bowls of Chien ware, with the oil-spot or brown hare’s fur glaze (some times incorrectly labeled as Temmoku ware). The material used was a sandy stoneware clay formed crudely in bowls averaging 4 to 5 inches in diameter. The composition and microstructure were examined in his laboratory at FCU. The streaks, which gave the appearance of hare’s fur, were identified as stringers of oriented micro crystals of iron oxide in the glaze.

During the years in China, Prof. Sutton and his students visited many of the pottery and clay working facilities in the Province. They visited plants making brick and roofing tile, and pottery (making large water jars up to 30 inches in height). These plants used local clays, crude kilns, and processes that remained unchanged for several centuries.

In late 1939, Prof. Farley left FCU for the US. Because the Japanese blockaded the seaports and threatened river and road travel during the day, he had to leave behind most
of his extensive collection of Tehwa porcelain and art ware, bronzes and other artifacts (which were lost, presumably to the Japanese). Unfortunately, his untimely death in the US at the age of 41 precluded the writing of a wealth of many scholarly publications based on his years of exploration, discovery and study.

**Alfred University (1941-1961)**

Prof. Willard J. Sutton joined the faculty of the New York State College of Ceramics in September of 1941. Because of his strong admiration and affection for the Chinese people and students, he actively supported efforts to get Chinese and Asian students into US Universities. The US support for education in China had come to a halt after Dec. 7, 1941.

In 1938, when he was aboard the SS President Coolidge on his way back to China, Prof. Sutton wrote a letter to Nelson J. Norwood, President of Alfred University, requesting the admission of one or more of his Chinese students to Alfred (a typewritten copy of the letter is shown in Insert 7). In 1940, President Norwood sent a memo (See Insert 8) to Mrs. Groves suggesting that she preserve the letter and photos in the Steinheim Museum. He also noted that “Doctor Sutton is sometime going to be a figure in the past in Alfred’s relations with China, and the letter may be increasingly valuable”.

During the years at Alfred, Prof. Sutton taught several courses in ceramics and also a course in geology. Many of the ceramic engineering students remembered his introductory course to the freshmen on ceramics and pottery making.

Prof. Sutton continued to study clay bodies and glazes, and even spent time using the pottery wheel to make clay vessels (see Photo in Insert 1.2). One investigation, which was jointly carried out in the Ceramic Research Department, was to further study the formation of the type of hare’s fur found in the Chin ware glaze. The composition and firing temperatures of glazes that contained oil spots were identified. Under controlled firing and cooling conditions, the oil spots would flow down and over the sides of the ware to form thin streaks of aligned micro crystals of iron oxide. One of Prof. Sutton’s students BS thesis showed that an oil spot glaze could be developed from a New York, Albany slip clay. The results indicated that the Chien ware glaze probably originated from a single clay slip.

In 1950, he wrote a thesis for the degree of Professional Ceramic Engineer, entitled, “*The Contribution of American Universities to the Development of Industry and Engineering in China, With Particular Reference to the Ceramic Industry*”. A short section on ‘Education in Ceramic Art’ was included. Prof. Sutton summarized his teaching experiences in China and emphasized the importance of preparing students to meet the future requirements for industrial and economic growth in China. Prior to WWII, the important role of the US State Department in advancing Science and Engineering in China was highlighted. However, by not understanding the differences in the Chinese culture and the way of life in the US, he stated that the many of the US universities had failed to give the best science training to Chinese students. Reasons for this were
discussed. He cited several case histories of Chinese graduates that had gone into the work place.

He then reviewed briefly the history of the ancient and modern pottery industry in China, and offered some suggestions for improvement. He noted that much of China was still using ancient manufacturing methods and gave examples. However, not all of the methods were inefficient. The design and building of the high efficiency tunnel kilns in Tehwa was given as an example. These kilns were the product of the remarkable intuition and creativity of the ancient Chinese potters.

He also mentioned in the thesis some of the modernization that was in progress in other ceramic and glass plants in China. Due to the War, the future of the ceramic industry was uncertain. However, he predicted (in 1950) that the Chinese had always been survivors and that “In 25 to 50 years, China would again become a major culture and power”.

In 1952-54, Prof. Sutton received a leave of absence from Alfred University and went to Bandung, West Java under a UN Technical Assistance program in ceramics. He visited and consulted with numerous ceramic industries throughout the Island, and wrote several detailed reports on his findings.

In 1961, he retired from Alfred University. In August of 1961 he was on a world tour and visited his graduated students in Turkey and Egypt. A special reunion was held for him in Singapore by twenty of his FCU students in order to honor him as a teacher and mentor; a moment that he always cherished and held dear to his heart.

In late 1961 to 1964, he taught ceramics in the Engineering Department at the Gadjah Mada University (18,000 students), near Jogakarta, Indonesia.

Finally, Professor Willard J. Sutton above all was a teacher, trainer, and inspiration to students both in China and at Alfred. He developed a keen interest in Chinese ceramics and pottery, trained students in ceramics and provided technical support to the Fukianese, and later to the Indonesian, ceramic industries. Perhaps his greatest attribute was the close camaraderie and associations that he developed with his students through out their careers. He taught chemistry (and ceramics) to hundreds of Chinese students.

Professor Sutton died in March of 1970.
The Faculty and Administration Officers 1931

Fukien Christian University
FOOCHOW, CHINA
Incorporated in New York, U.S.A.

American Office
150 Fifth Avenue, New York, N. Y.

FCU Science and Fine Arts Halls.

Min River Campus 1922-1942
Views of Fukien Christian University, Foochow, China

FCU Chemistry Laboratory.

Boats on Min River Heading to Foochow

View of Min River from FCU Campus

Pottery made by Prof. Sutton's Students

Plane Bringing Mail to FCU

Dr. Ellen Sutton Treating a Patient

Prof. Sutton - AU Pottery Lab 1946
Visit to The Tehwa Porcelain Center, May 1935
By the First Western Scientist [Prof. Willard J. Sutton] and Archaeologist [Prof. Malcolm F. Farley], both from the Fukien Christian University. Prof. Sutton took the photos

Green, Farley, Sutton, Chiang

Tehwa and Surrounds

Prof. Farley Examining century Old Sherds

Carrying Clay to Pottery

Water Wheels in Huts
Kilns on the Hillside

Kiln, Stacks of Wood and Saggers

Send Products by Boat

Carrying Product to Market

Tehwa Porcelain Goddess
THE MANUFACTURE OF PORCELAIN NEAR TEHWA, SOUTH CHINA

BY WILLARD J. SUTTON

ABSTRACT

Tehwa was the most famous center for the production of blanc de Chine during the Ming and Ch'ing dynasties, beginning in the 14th Century, and is considered to have been the second most important center in China in its influence on the work of potters in Europe and America. Owing to its inaccessibility, relatively few visitors have seen the work carried on in this old center. The processes still in use are about the same as they have been for centuries except that overglaze decoration is now quite common. The Tehwa kilns are efficient and are undoubtedly the best developed in China. The steps in manufacture are described.

I. Introduction

Long before the Middle Ages Chinese pottery was well known wherever Arab traders were found. During the early years of the 14th Century, a few choice pieces of porcelain found their way to Europe where they at once became the prized possessions of kings. Being far superior to the pottery then made in Europe, these Oriental specimens created a sensation, and since that time Chinese ceramic art has exercised considerable influence on the work of European and American potters. The universal use of the terms "china" and "kaolin" pay tribute to the potters of China who first discovered the art of making hard porcelain.

Among the better porcelains produced in China is a group known as blanc de Chine or Chinese white. Most of this type of ware (see Fig. 1(A)) was produced near Tehwa (Teoua), a small city sequestered in the mountains of Fukien province, about one hundred miles inland from the port of Amoy on the South China coast. This porcelain has a fine white body, varying from ivory to a slight bluish tint, and depends for its beauty upon the superlative quality of the body and glaze, its translucency, and upon the work of artisans who have shown remarkable skill in modeling figures of Chinese deities (see Fig. 1(B)). Other objects consist of many types of incense burners, libation cups, and vases. Modern Tehwa ware reproduces the older types in varying degrees of quality and includes large numbers of cheap teacups, teapots, and porcelain spoons so commonly used in China. Although some blue and white ware was produced several centuries ago in the Ming dynasty, this center was known only for its white ware, but present-day production includes many overglaze color decorations with the free use of gold. Much of this decoration consists of scenes copied from conventional Chinese paintings.

* Presented at the Forty-fifth Annual Meeting, American Ceramic Society, New Orleans, La., March 29, 1938 (Art Division). Received April 23, 1938.
has given a good outline of the modern manufacture of electrical porcelain in Shanghai. Lewis has recently described the manufacture of common pottery near Canton in South China.

Owing to the fact that the Tehwa people speak the Amoy dialect, practically all conversation had to be carried on through an interpreter which made it difficult to get accurate information. The principal steps in making porcelain as described here were obtained by direct observation and by questions asked of the potters while at work.

II. Raw Materials

The plastic clay body which is used for making porcelain is prepared by grinding and washing a grayish white weathered rock, which is apparently a natural porcelain mixture. The deposit visited was about 1½ miles from Tehwa near the top of a 400-foot hill covered with a sandy reddish-brown clay. The rock is found from 6 to 20 feet below the surface and is dug from pits and shafts (see Fig. 2 (A)). The rock, which is found in various stages of weathering, is sometimes piled on the ground for further weathering but is often carried in baskets directly to the streams where it is ground by water power. Softer rock, which seemed to be a partially weathered feldspar, was used for the body while the harder pieces were said to be used in making the glaze. A microscopic examination of the rock revealed but few quartz grains and a few grains of dark iron-bearing minerals.

The grinding is carried out by placing the rock under steel-tipped hammers on long wooden handles operated generally by 8-foot over- or under-shot water wheels (see Fig. 3 (A)). These mills are similar to the rice mills used in China for centuries. After many hours of pounding, the rock is stirred in nearby water pits to separate out the coarse particles for more grinding. By settling and drying, a plastic body is obtained which is ready for the

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Fig. 2.—(A) Scene at clay mines. (B) Potter's wheel showing parts and construction.

Fig. 3.—(A) Water mills for grinding rock. (B) Crude muffle kilns for firing overglaze colors.
80 cents per day (about U. S. $0.25). Most of the teacups are made in Chinese styles without handles.

The molded figures of Buddhas, etc., are made by pressing the plastic body in a mold of porous fired clay. Two such half molds are then joined together, forming a complete figure in which all details are put in by hand, showing delicate designs of beadwork, fingers, etc., of unbelievable fineness. These figures vary from 12 to 18 inches in height, but a few are much larger.

Porcelain spoons are made in larger numbers in porous clay molds. These are packed in layers of rice hulls which are burned and snuffed for a long time producing a soft biscuit ware. The ware is then glazed and fired in saggars. With the exception of spoons, practically all Tehwa porcelain is one-fire ware, where body and glaze are fired together.

After applying the glaze already described, the various types of ware are dried on boards in crude sheds, packed in round saggars from 12 to 14 inches in diameter, and stacked in the kilns. Small laps of clay and layers of ashes prevent the glaze from sticking to the saggars.

IV. Firing

The simplest Chinese kilns are like tunnels, built up a slope to produce draft. The firing progresses from the bottom upward and small sticks of wood, grass, etc., are fed in through small openings. The Tehwa furnaces are a great improvement over this simple type (see Fig. 4 (D) and Fig. 5). They usually consist of 6 large compartments, each joined by about 16 openings, approximately 6 inches wide and 1 foot high at the floor level. Each compartment is about 20 feet long with an arched door at each end. The height from the lower floor level to the top of the crown is 18 feet, and the width is about 10 feet. The bottom of the kiln consists of a series of steps, 6 to 8 inches high, running across the kiln from door to door. These are about 15 inches wide, and each will accommodate one row of saggars, but the lowest level, which is somewhat wider, is directly opposite the doors and near to flue openings from the next compartment below it. Here the wood is thrown to burn directly in front of the openings which admit hot air from the cooling compartment below. The flame passes upward to the crown or through the bungs of saggars and out the series of openings at the upper side into the next compartment. In this way, a cooling compartment preheats the air before it enters the firing zone. The first and lowest compartment is preheated by firing a small chamber just below the main kiln and connected with it.

It takes approximately three months of normal production to fill one of these big kilns and a village will be built around from one to six of them. Such work in China is carried on by families, and a potter practically lives next to his wheel, aided by his wife and children. A section of a kiln may be owned by one family and part of it may be rented to another group, while a well-to-do potter may own several sections or have part interest in separate kilns.

When a kiln is filled and ready for firing, all who share in it must contribute wood for a preliminary firing of the small chamber connected to the lowest compartment. This firing is carried on for approximately twenty-four hours before firing starts in the first compartment. Wood, 3 to 5 inches in diameter (see Fig. 4 (C)), is fed in through a small opening in each door for about one day until, by draw trials or by experience, the foreman judges the right amount of heat has been obtained. The firing is then started in the next compartment and so on until the end, a total of seven days.

These kilns are efficient, but they have the disadvantage that all who use one must wait until the entire space is filled with saggars. The ware nearest the fire is often overfired. No good temperature measurements are available. About fifty miles north from Tehwa is another little-known porcelain center at Minting. Its products and methods, as well as raw materials, are similar to those at Tehwa. One of the author's students who worked at Minting placed some pyrometric cones in a sagger about the center of one compartment; cone 14 was reported to have been down in a typical firing.

V. Decoration

White Tehwa porcelain is still quite common, but a large production of ware decorated with overglaze colors is now an important part of the output (see Figs. 3 (B) and 4 (D)). Plain white teapots, teacups, trays, etc., are bought by the decorators from the kilns where they are fired and are carried into Tehwa for decoration. A decorator's shop is generally provided with the common colors and will quickly make to order any of a number of standard designs. In one shop, a well-known American brand of liquid gold was used, but Japanese and British colors are common.

Before leaving Tehwa after a three-day visit, the author and others in the party ordered special tea sets, each consisting of a teapot, ten cups, and a tray. Special designs and colors were selected, and an inscription was written in Chinese upon each piece commemorating the visit. These sets were ready and delivered to a place nearly fifteen miles away two days after ordering. The price of each twelve-piece set, specially made up and delivered, was 40 cents (U. S. currency).

The overglaze colors are fired in a small, crude, updraft muffle kiln about seven feet high (see Fig. 3 (B)). Wood is burned in openings near the floor, and the flame passes upward around a sort of tile muffle containing the decorated pieces.

VI. A Glimpse into the Past

When asked how old Tehwa is the potters always answer vaguely that it is very old. The furnaces are not used very often and seem to be well built. Every village, however, has old furnaces out of use, waiting for repairs, and some are too old to recondition. When a kiln site has been used
for a long time, broken saggars and pottery so fill the place that a new site is chosen rather than remove the débris from the old location.

Just as the recent widespread road-building program in China has uncovered large quantities of pottery from graves, so the road cuts near Tehwa have uncovered long-buried kiln sites where no trace of them could be seen above ground. Within a mile from Tehwa, two such sites were found with broken white porcelain showing in cuts in the bank. Over one of these sites a tree with a trunk fourteen feet in circumference was growing. By digging at the roadside, parts of saggars as well as a number of broken cups were removed. These were quite different in shape from those now made there. All authorities agree that Tehwa was making white porcelain during the Ming dynasty and is therefore at least five hundred years old, but the belief is growing that it is considerably older than that.

Acknowledgments and Corrections

The expenses for the visit to Tehwa, described here, were paid by the Fukien Culture Society at Fukien Christian University in Foochow. Thanks are due to missionaries and Chinese friends who made the trip comfortable in Tehwa and on the road.

Henry Jewett Greene went along on this trip as a guest. On returning to the United States, he wrote a letter6 to the editor of This Bulletin describing the Tehwa kilns. By mistake, Mr. Greene sent a photo of a kiln producing water jars which he obtained from another part of China, but labeled as coming from Tehwa.

Several other errors will become apparent by comparing the letter in The Bulletin with the text of this article. It is most unfortunate that this photograph should have been reproduced in a recent book6 on Chinese glazes, as being a Tehwa kiln.

DEPARTMENT OF CHEMISTRY
FUKIEN CHRISTIAN UNIVERSITY
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德化之瓷業

引言

福建德化為吾國瓷業重要區域之一，其瓷業之歷史可追溯至明代，迄今五百餘年矣。其產所產之瓷品，質地細膩，質地坚硬，釉色純淨，紋飾精緻，為瓷業之上品也。德化在明代，尤以善造佛像著名，如如來，如觀音，如彌勒，如諸佛、菩薩等神像，皆為其瓷業之傑作；選售全國，名聞遐邇。本年春假，福建文化研究會有致考察德化瓷業之舉，作者隨行考察。其後考察情況，得目觀其地勢，得聞其街道之景觀，略寫叙述，並詳見文章，以資後代瓷業之參考，未盡之處，尚待讀者不吝指正焉。

瓷業之概况

德化人口有十萬餘人，經營瓷業者，約有十萬餘人，今時僅有五千餘人；蓋晚近受外貨之競爭，銷路欠佳，且運輸困難，損耗甚多，更因匪患未靖，瓷業乃漸衰落矣。全縣製瓷區域，計有十處，每年產量，昔時有五十餘萬件，今則十餘萬件而已。製瓷區之名稱，見下表及德化全縣略圖。與第一圖：

—— 1 ——
Map of Tehwa and Surrounds
Professor Willard J. Sutton,
Fukien Christian University,
Foochow.

Dear Professor Sutton,

I beg to acknowledge receipt of your letter of the 16th instant, together with a report on your trip to Tehwa and a reprint of your former thesis on Tehwa-porcelain, which I have not had the pleasure of perusing until now on account of my long absence from Foochow.

I wish to avail myself of this opportunity to extend to you the appreciation and gratitude both of myself and of the Fukien Provincial Government for the painstaking efforts and the valuable services you have rendered in connection with our porcelain industry in Tehwa.

Your report and thesis are both interesting and enlightening, and the suggestions you have made therein deserve our greatest attention. Instructions have been given to Mr. Kuo and Mr. Hwang of our Tehwa Experiment Station to make a careful study of the porcelain industry along the lines suggested by you. I hope that very soon some concrete improvements can be attained and that we can always profit by your advice and assistance.

Thanking you once more,

I beg to remain, dear Sir,

Faithfully yours,

D. P. Nyien
D. P. Nyien.

Letter From Fukien Provincial Government To Professor Sutton
Tê Hua Through the Centuries

Marco Polo left Ch’üan-chou (Chinchew) in Southern Fukien in 1292 for Persia and three years later in 1295 after twenty-six years’ absence he arrived in his native Venice. It is just possible that the famous Tê-hua “blanc de Chine” censer, the so called Marco Polo censer, preserved in the Treasury of St. Mark’s in Venice actually was brought back from China by Marco Polo in accordance with the tradition that has been long associated with it. This, the experts who have proved otherwise notwithstanding.

An auspicious combination of circumstances has
And one of the two or three most significant statements that Marco Polo makes about his visit to the city of Zayton (Chinchew, now called Ch'üan-chou), the port from which he sailed for Persia in 1292, was about the manufacture of porcelain, somewhere in the province. This is what he says. "Let me tell you that in this province there is a town called TYUXJ, where they make vessels of porcelain of all sizes, the finest that can be imagined. They make it nowhere but in that city, and thence it is exported all over the world. Here it is abundant and very cheap, insomuch that for a Venetian groat you can buy three dishes so fine that you could not imagine better."

Perhaps the oldest and certainly the most romantic and exciting ceramic traditions in all Europe about Chinese porcelain are those, the one about the Tê-hua censer in the Treasury of St. Mark's at Venice, called the Marco Polo censer and supposed (as indicated above) to have been brought back by him from the Fukien city of Ch'üan-chou (Chinchew); the other about the Crusader's Cup, a small inlaid cup of Tê-hua "blanc de Chine" supposed to have been brought back to Europe from the Orient by the Crusaders and now in the Dresden Museum.

It is quite true, let us bear in mind, that both of these traditions are definitely and positively denied and considered untrue and impossible—proved to be so—by all the ceramic experts and authorities of the Western World. It is also quite true that neither of them will ever be able to be proved to be true. But what thrilling traditions!! It is just such traditions as these with all their possibilities that start curious-minded people searching and researching.

Tê-hua! Mother of "blanc de Chine", Queen of porcelain!! The finest, the most beautiful, and the most highly prized (and priced too) Byzantine porcelain figures in the world are Tê-hua. The creations of the Tê-hua artists are considered the master porcelain sculptures of the East.

Many of the leading authorities of the world on Chinese ceramic art consider the Tê-hua "blanc de Chine" as perhaps the most beautiful white porcelain ever made.

Probably the largest, the most comprehensive, and the most representative collection of Tê-hua ware in existence (excluding of course the center of manufacture itself with its centuries of ceramic dump-heaps), including all types of wares, colors and shades of colors, shapes, styles of decoration, etching under the glaze and applied decoration over the glaze, all styles of painting, whole pieces and sherds, under-fired and over-fired, large and small, big and little, from all sources and of all dates, from the origin of the ware down to the present day—is on the University campus.

And yet, in spite of all this interest and influence and collecting and knowledge of Tê-hua products, up until the time of the University expedition of April and May a year ago, so far as is known no person possessing either ceramic or archaeological knowledge had ever visited the
village of Te-hua and absolutely nothing concerning the origin and very little concerning the history of its ceramic activity can be found either in the books of China or those of the Western World. All this history remains to be written.

Note—It this short article on Te-hua it has not at all been the intention of the writer to furnish references for the many statements categorically made, even when these are of facts already accepted and proven. For these and other statements not yet proven he will present evidence in a future article.
Dear Pres. Norwood:

This is the eighteenth day out of San Francisco, — we will be in Manila three days Oct.13 -16 then for the first time I will see the China coast near Hong Kong Oct. 18.

People were so interested in possible war in Europe that most of them failed to consider the Far Eastern aspects of the situation. In my case, if war had taken fire Oct. 1st, I could not have gotten into Foochow, and possibly not even to Hong Kong. War in Europe would have been a great blessing to the Japanese cause, — they could then attack British and French shipping, take the International and the French settlements in Shanghai, and try, with fair chance of success to take Hong Kong.

According to Japanese newspapers, which I saw in Yokohama, there was a big fire reported in Foochow, which destroyed all Japanese property. This came through Japanese sources and may be quite distorted, — I hope it is not the beginning of an attack or reprisal. I had not looked for much trouble in Foochow until after the fall of Hankow.

Yesterday was Oct.10, the big Chinese National holiday, corresponding to our July 4th. The Japanese had hoped to take Hankow before this time and make this day a grand victory celebration to destroy Chinese morale. They are quite a little behind schedule.

On board we have had Richard Halliburton and party. He has written quite a number of adventure books and done quite a bit of adventuring on his own. He is now commissioned to go to China; buy and outfit a junk and sail it to San Francisco, to become one of the features of the Fair next spring. Mr. Halliburton was quite interested in studying my photographs of Foochow junks, and asked very many questions as to the possibility of getting one there and fitting it out. I am afraid he is in for a real task, with war conditions at the start and winter weather to sail in.

We left him in Japan trying to get assurances of safety from the Japanese government.

The Japanese navy has quite ruthlessly sunk many Chinese boats. Our Foochow junks are the most attractive in appearance of all the Chinese boats, so I hope he can get one. They are very seaworthy.

I wish now that I had been a better student of history. It seems absurd that Hitler can occupy the center of interest so much, when he will not be able to command the attention of future generations, — while China is destined to become a world center in spite of all that Japan or any other nation can do. Just now a migration is going on that really has great significance. The Chinese have been too content to develop their coastal provinces, so that now most of their educational and industrial centers are over run or seriously threatened by the Japanese. Up until this last year Chinese students, bankers, etc. have been quite uninterested I going to develop the inner provinces. Szechwan has been called the Texas of China and holds vast natural resources, but is quite backward in many ways. With the present war all has been changed, — countless thousands of refugees have left everything behind and are marching to the west to find new homes. Schools have moved bodily to reestablish themselves over a thousand miles up the Yangtze river, whole industries have likewise been transplanted. People of means have fled there for safety, artists, teachers, engineers have moved out starting life anew. It has been the plan of the Chinese government to withdraw into West China, in case the Japanese are able to capture all the coast provinces. But this mass migration seems greater by far than the government could have planned, or even dreamed.

I was just nicely started on another year in Alfred when I was called to go back as soon as possible. I have no idea what I will be doing, or how much trouble there will be getting in to Foochow, but will try to let you all know later. So far only two pieces of American property have been damaged by aerial bombs. The Christian Herald School and the home of Doctor Gillette.

If I had known that I would leave so soon, I would have called on you, but the last month was crowded with duties and preparations to leave.
One thing I would like to make as a suggestion — the admission of one or more Chinese students to Alfred. Exchange is very unfavorable, and travel is expensive. When I left China it took Chinese $3.35 to buy an American dollar, and now it takes six or more, due to war conditions. If Alfred could offer a scholarship or other assistance it would help. In any case do not accept students unless well recommended by some school. Two of our students have gone through Alleghany College this way, and others would like to go. Of course under normal conditions the colleges in China offer adequate undergraduate work, graduate and specialized courses such as ceramics are more in demand.

With best wishes to you, I am,

Very sincerely yours, W. J. Sutton

Dramatic picture of Chinese Junk from the rear. Photo by W. J. Sutton

FATE OF HALLIBURTON REMAINS A MYSTERY

ILL-FATED EXPEDITION STARTED JUST YEAR AGO

SAN FRANCISCO, March 4 (AP) — One year ago Sunday in Hong Kong, Richard Halliburton, 39-year-old American adventurer, gave the final once-over to a 65-foot Chinese junk in which he hoped to sail to the Golden Gate International Exposition here. He and his crew of 14 left the next day, but the rest of the story — similar in hardship to the many which Mr. Halliburton lived to write — is in the keeping of the turbulent Pacific.

The man who climbed the Matterhorn and led expeditions to remote parts of the earth vanished 20 days later when a near-typhoon swept the junk’s estimated position 1200 miles northwest of Midway Island.

Mr. Halliburton planned to negotiate the 7000 miles in less than two months. But on March 24 this message was received by the liner President Coolidge from the junk’s master, Capt. John Welch of San Francisco: “Southerly gales, rain squalls, lee rail under water, wet bunks, hardtack, bully beef, having wonderful time. Wish you were here instead of me.”

It was the last word from the Sea Dragon. Nearby ships rushed to aid. The cruiser Astoria combed 152,000 square miles — to no avail.

Months later, a Memphis, Tenn., court declared the author dead. His will left the income from a sizable fortune to his parents. Mr. and Mrs. Wesley Halliburton of Memphis, and provided at their deaths the money was to go to the library of Princeton University, from which Mr. Halliburton was graduated. He was unmarried.
My dear Mrs. Groves:

I am sending you herewith a letter written sometime ago by Dr. Willard Sutton. It is accompanied by some pictures which are named on the back. I judge they were taken by Doctor Sutton himself. It might not be a bad idea to preserve these in the Steinheim, the pictures at least. Possibly also the letter should be preserved. Of course, Doctor Sutton is sometime going to be a figure in the past in Alfred's relations with China, and the letter may be increasingly valuable.

Sincerely yours,

[Signature]

President