37. The Sino-Swedish Institute

for Scientific Research in Shansi Province, N. China, and Erik Norin's first years in China

By

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Introduction

The author had already spent 16 years in China, 11 of them as Professor and Dean of the Faculty of Natural Science at the Shansi Imperial University in Taiyuanfu, N. China. I now wanted a few quiet years in Sweden and resolved to use the opportunity for study and possibly attaining the degree of M.Sc. (Fil. Lic.) at Stockholm University in the department of Mineralogy where Percy Quensel was professor.

One day, as I was sitting at my microscope, in strolled a young man, "blond and Swedish-looking", as I say in my diary. His name was Erik Norin, 24 years old and a B.Sc. (Fil. Kand.). He carried an introduction from my trusted friend Percy Quensel and said that his ambition was to go to China and serve me in any suitable manner. This was indeed a surprise and required investigation and consideration. But the possibility of some years of peaceful and successful exploration in Shansi was there, inasmuch as the province was then controlled by a very progressive and hard-working official, namely Yen Hsi-Shan (himself from Shansi), who was rightly called "the Model Governor of China".

The result of my considerations for and against was therefore, that on February 12th, 1919, Norin and I signed a contract regarding one year's experimental work in Shansi. As the geological exploration was most urgently needed, this and Erik Norin took the first place, but I did not forget to include zoology and botany in our research planning.

At the beginning of 1920 (after obtaining my M.Sc. degree) Norin and I proceeded to Shansi and were soon joined by Harry Smith (a botanist from Uppsala University) and David Sjölander (a zoologist from the Museum of Natural History, Gothenburg). Thus the establishment of the Sino-Swedish Institute in Taiyuanfu was accomplished, and in the years to come not less than 26 printed papers were issued.[1] The Institute was sometimes called the Nyström Institute in honour of its founder (fig. 3). The work of the institute and Norin's contribution to it may require a brief introduction into

[1] See list of papers on p. 461.

The geology of the province of Shansi

The oldest rocks of the province form an intensely metamorphosed complex of orthogneisses and schists, intruded by granites and basic dykes, which complex, since the days of RICHTHOFEN, has been distinguished as the *T'ai Shan System* of the Archaean.

The succeeding (in ascending order) *Wu T'ai System* has not as a rule suffered such a powerful metamorphism as the T'ai Shan rocks. The Wu T'ai System has been studied at its type-locality, Wu T'ai Shan in N.E. Shansi (fig. 1) by C. C. SUN of the Sino-Swedish Institute (see paper No. 12). He states that the main Wu T'ai range is made up of chlorite-schists and quartzites, but white marbles and mica-schists occur in the lower parts of the system. He estimates the total thickness at "several thousand metres". The Wu T'ai beds have been intruded by a coarse-grained granite.

Continuing upwards, we encounter a vast series of ancient sediments. Recent discoveries of fossils in its upper parts have caused this *Sinian System* to be included in the Palaeozoic. We find in descending order:

(3) Limestones (not marine) with interbedded sandstone and shale.
(2) Effusive diabases and tufaceous beds.
(1) A thick complex of continental sediments.

The typical development of the Sinian can be studied at the Western margin of the Mo-Erh-Tung horst (cf. *Bull. Geol. Inst. Ups.*, Vol. XXII, p. 67), and at the S.W. margin of the Wu T'ai massive (figs. 1 and 2).

The Sinian was followed by a period of marked orogenic movements and a period of denudation, whereby most of the sediments were removed. The succeeding *Cambrian* sediments have been deposited upon a very extensive peneplain. The lowermost beds of the Cambrian, called the Man-T'o formation, generally appear as a pink, very fine-grained quartzitic sandstone of 80 m thickness, and superimposed on this formation are the Man-T'o shales (10–25 m) of maroon colour and with interbedded, impure limestones. The Man-T'o shales are conformably overlaid by a marine series of strata (Middle and Upper Cambrian and part of the Ordovician). The latter is represented by a thick, rather pure limestone, and the aggregate thickness of the *Cambro-Ordovician limestone* has been estimated in W. Shansi to be about 1100 m (fig. 2). It resists weathering and is a conspicuous feature of N. China geology.

In ascending order we now arrive at the Lower *Carboniferous* or Dinantian. In Upper Dinantian there was a great spread of the sea, and it was at this time that the Taiyuan Series was formed (about 125 m thick). The invasion of the sea was not continuous, but happened as a succession of marine intercalations (of thin limestones), near Taiyuanfu not less than eight in number (richly fossiliferous), and the ten coal-seams in their neigbourhood obviously originate from organic material accumulated in the vicinity of the sea, or, to be more explicit, on the frontier between the sea and fresh-water basins.

To establish order in the information about the late Palaeozoic in Shansi we propose to quote Prof. T. G. HALLE: Palaeozoic Plants from Central Shansi, where the numerous fossil plants, collected by ERIK NORIN are enumerated and described. NORIN divides the Upper Palaeozoic and supposed Lower Mesozoic sediments in central Shansi into three series, given below in ascending order.

1. The *Yuehmenkou Series* of black argillaceous shales, dark grey calcareous shales, coal-seams and light-coloured quartz sandstones, interbedded with dark marine limestone and calcareous shales. The thickness of this series is 150–200 m. West of Taiyuanfu it rests on Ordovician limestone and is divided by a disconformity into a lower part, about 125 m thick, which is named by Prof. GRABAU the *Taiyuan Series*, and an upper part, about 65 m thick, which is referred by the same author to the *Shansi Series* in a restricted sense. The lower part of the Yuehmenkou Series is regarded by GRABAU and NORIN on the evidence of fossils as representing the uppermost part of the Lower Carboniferous or possibly the beginning of the Moscovian, and the upper part as Permo-Carboniferous.

2. *The Shihhotse Series*, consisting of generally light-coloured fresh-water and delta deposits without marine intercalations and almost without coal-seams, but very rich in fossil plants. The thickness is about 450 m. The series was divided by NORIN into two parts: the Lower and Upper Shihhotse Series, both placed in the Permian.

3. *The Shihchienfeng Series*, formed under more or less arid conditions, and composed of red-brown and chocolate-coloured clay-stones, sandy clays, marls and red-brown sandstones. The thickness exceeds 700 m. The lower part (150 m) is gypsiferous. In the upper part (550 m) fine-grained sandstones, regarded by NORIN as aeolian, predominate.

Both west and east of Taiyuanfu, the Taiyuan series is typically exposed. There are several distinct limestone zones, each characterized by distinctive fossils. The coal-seams, both bituminous and anthracitic, generally occur immediately below the thin limestones and are extensively worked, especially in the Western Hills near Taiyuanfu and in East Shansi in the P'ing Ting district, half-way between Taiyuanfu and the Hopei Plain (fig. 1) which has been famous since ancient times for its export of anthracite and iron-ware for agricultural and household use.

The Jurassic Coal-field at Ta-T'ung, N. Shansi.—In the Mid-Permian the emergence of Shansi from the sea was definite, and no more marine sediments have ever been deposited here after that time. The Chinese continent as a whole was definitely established at the end of the Triassic. But numerous large inland basins were formed during the Jurassic, and here and there plant life flourished, giving rise to Mesozoic coal-fields of great importance. The Ta-T'ung coal-field in N. Shansi (fig. 1) is an example and produces bituminous, non-coking coal of great purity. I have analyzed many samples from this

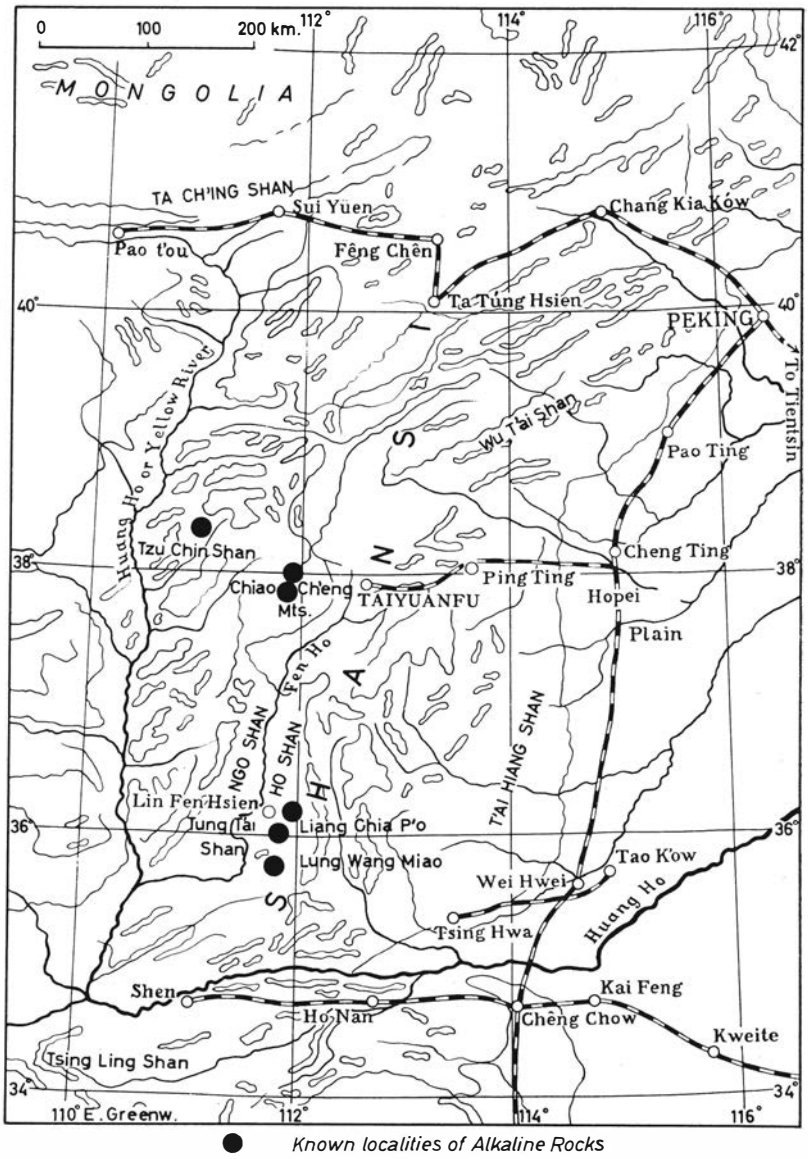

Fig. 1. Map of Shansi Province. The railways pointed out on the map show the conditions about the year 1925. In our days the railway net has been considerably changed, new lines having been constructed, others withdrawn.

field and often found the phenomenally low ash-content of less than 1 %. The Jurassic at Ta-T'ung shows:

(1) Freshwater sediments and arid sandstones, about 1000 m.
(2) White and greenish clay-sediments and sandstones, 200 m.

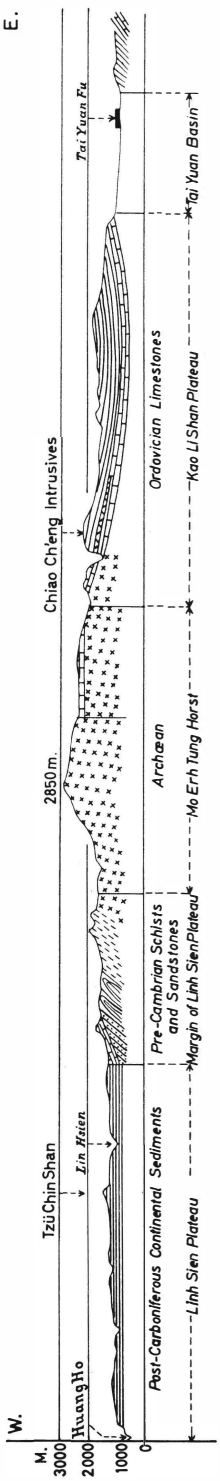

Fig. 2. Diagrammatic section through western Shansi.

Summary of Shansi stratigraphy.—The succession of principal formations in Shansi is shown here, in ascending order:

Archaeozoic	T'ai Shan System
Proterozoic	Wu T'ai System
Palaeozoic	Sinian System
	Cambrian: Lower, Middle, Upper
	Ordovician: Lower, Middle
	Carboniferous: Lower
	Permo-Carboniferous
Mesozoic	Triassic
	Jurassic
Caenozoic	Tertiary: Eocene, Miocene, Pliocene
	Quaternary: Pleistocene, human culture deposits, loess, recent volcanoes.

The Shansi formations of economic and industrial value and general interest are in ascending order:

The Wu T'ai formation: Splendid white marbles for tablets and ornaments.

The Cambro-Ordovician Limestone for building purposes and cement-making.

The Taiyuan Series (Carboniferous). In lower strata on top of *Actinoceras* Limestone we find scattered pyrite and nodular iron-ore. Also gypsum, sometimes in workable quantities (for cement). Interesting marine limestones with fossils. Coal-seams both bituminous and anthracitic, extensively mined. Permian *Shihhotse Series* contains abundance of plant-fossils, which were collected by E. NORIN and described by Prof. T. G. HALLE in Sweden. *Jurassic:* Coal-field near Ta T'ung in N. Shansi with four seams of pure bituminous, non-coking coal (ash often less than 1 %).

Caenozoic: Pleistocene *Loess*, blown hither from Mongolia. Yellowish-grey, fine-grained, semi-solid formation, almost universally present at medium altitudes in Shansi. Seldom more than 50 m thick. Often containing lime-concretions, "Loess Dolls", and cleaving vertically.

In the Pleistocene we also place the interesting and well-preserved small volcanoes of Stromboli type, about 30 km east of Ta T'ung in N. Shansi. They have been described by GEORGE B. BARBOUR and M. N. BIEN. (See paper No. 21.)

History of geological exploration in Shansi

As early as 1870–1871 the famous geologist Baron FERDINAND VON RICHTHOFEN visited many provinces in China, including Shansi, and in 1882 his exploration resulted in the publishing of five large volumes and two atlases.

In 1903 and 1904 two American geologists, BAILEY WILLIS and E. BLACKWELDER from the Carnegie Institution of Washington, D.C., investigated this province and published four large volumes as a result of their journeys. C. C.

[1] *Remarks*.—Very complete fossil lists may be found in J. S. LEE: Geology of China.

WANG and other scientists from the National Geological Survey in Peking paid frequent visits and published valuable reports. The Catholic missionaries Père E. LICENT and Père TEILHARD DE CHARDIN have contributed numerous reports and Prof. J. G. ANDERSSON reported on "Eocene deposits of Shansi" and gave information on plant-fossil localities and lent expert Chinese collectors. The Clark-Sowerby expedition observed and mentioned Tzu Chin Shan in W. Shansi (see paper No. 1 by E. NORIN) but, as their objects were the provinces Shensi and Kansu, they had not time to stop for a detailed investigation.

Shansi Imperial University was established in 1902 by Dr. TIMOTHY RICHARD and Dr. MOIR DUNCAN. I arrived in China that year and was soon engaged by that university as organizer and Dean of the Faculty of Natural Sciences, with modern buildings and laboratories in the S.E. corner of Taiyuan (fig. 3). I worked there until the revolution against the Manchu dynasty 1911, but was recalled as Professor of geology in the Shansi Government University in 1920. I organized the collecting of Shansi coal and ore samples for quantitative analysis, and the governor helped financially and had my report: "Coal and Mineral Resources of Shansi, Analytically Examined" translated into Chinese. This was useful "propaganda" for the needs of Swedish geologists.

Papers emanating from the Sino-Swedish Institute, Taiyuanfu, Shansi Province 1921–1935

1. E. NORIN: Tzu Chin Shan, an Alkali-Syenite Area in Western Shansi.
2. — The Late Palaeozoic and Early Mesozoic Sediments of Central Shansi.
3. D. SJÖLANDER: The Distribution and Habits of the Argali Sheep of Central Asia.
4. E. NORIN: Some Geological Notes on the Coal and Iron Ore Deposits in Carboniferous Sediments of Central Shansi.
5. — Investigation of the Thermal Dissociation of the Hydrated Alumo-Silicates Prehnite, Zoisite and Epidote.
6. — An Algonkian Continental Sedimentary Formation in Western Shansi.
7. E. T. NYSTRÖM: Shansi Waters Chemically Examined.
8. E. NORIN: The Lithological Character of the Permian Sediments of the Angara Series in Central Shansi.
9. H. SMITH: A Preliminary Report on Botanical Investigation Southern and Central Shansi.
10. E. T. NYSTRÖM: Additional Notes regarding Shansi Waters.
11. — Some Alkaline Rocks of Shansi Province, Northern China.
12. C. C. SUN: Some Observations on the Oldest Formations in Shansi.
13. S. L. TSAO: Gypsum Deposit of P'ing Lu District, South Shansi.
14. C. T. WANG and Y. L. WANG: A Study of General and Economic Geology along the Chengtai (Shansi) Railway.
15. GEORGE B. BARBOUR: The Origin of the Niangtzekuan Tufa.
16. — The Taiku Formation and Pleistocene Climates.
17. C. T. WANG: General and Economic Geology of the Hsiang Ning Coal-field, South Shansi.
18. E. T. NYSTRÖM: Automobile Roads in Shansi.

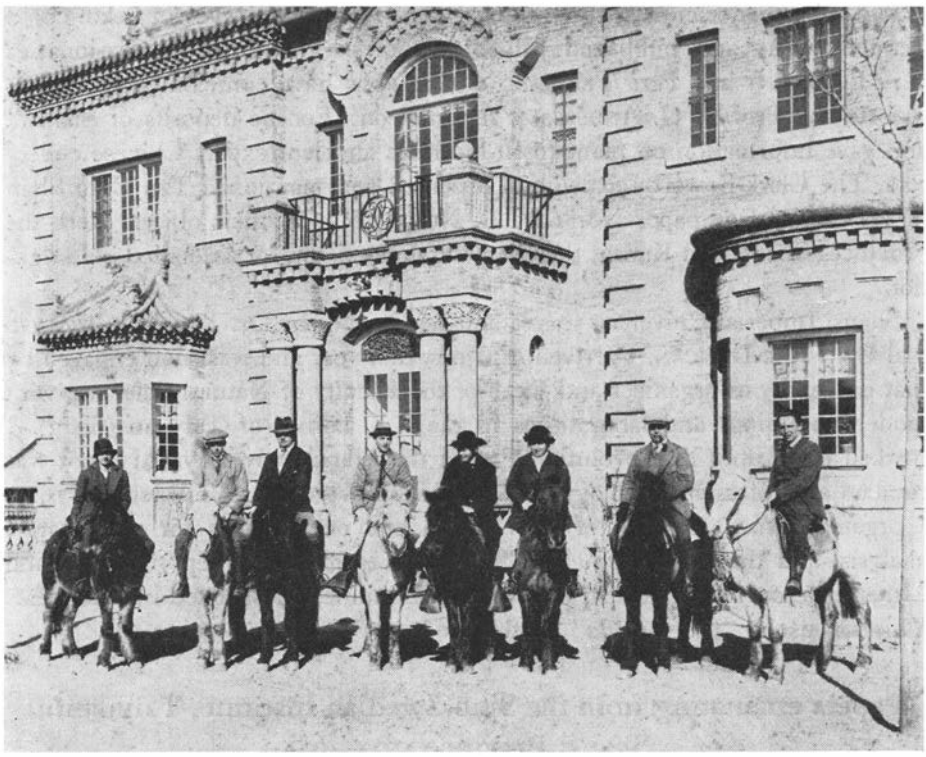

Fig. 3. The Sino-Swedish Institute for Scientific Research in Shansi, China. In 1922. Members of the institute with British friends in front, assembled to start on a picnic to the Twin Pagodas outside Tai Yuanfu. *Second from the left:* ERIK NORIN; *third:* DAVID SJÖLANDER; *second from the right:* ERIK NYSTRÖM.

19. GEORGE B. BARBOUR: The Superficial Deposits of Yütaoho, Shansi.
20. — The Age of the Basalts of Chinghsing.
21. GEORGE B. BARBOUR and M. N. BIEN: The Pleistocene Volcanoes of the Sangkanho.
22. RAYMOND T. MOYER: The Aridity of North China.
23. E. T. NYSTRÖM and S. L. TSAO: Alkaline Intrusives of Lutingshan and Ch'iaoshan in Southern Shansi.
24. RAYMOND T. MOYER: Introduction to a Study of Soils of Shansi Province, North China.
25. — Soils of Shansi Province.
26. E. T. NYSTRÖM: Geophysical Prospecting and its Possible Application in China.

ERIK NORIN's first years in China

Preparations for the expedition to Shansi.—As seen in the introduction, it was Prof. PERCY QUENSEL's recommendation, as well as the peaceful conditions in Shansi, that caused me to engage ERIK NORIN by a formal contract of February 12th 1919. And it was not long before the youthful scientist proved his worth by the intelligent and energetic way he prepared for his journey. Through the

benevolent decision of the Council of Professors of Stockholm University, NORIN obtained, in the form of a Liljevalch's scholarship, financial aid for procuring necessary instruments and other outfit for exploration in China. Such aid was also given by my brother Professor GUNNAR NYSTRÖM, and by my brother-in-law Dr. CARL LÖWENHJELM. And by kind permission of DAN BROSTRÖM, Director of the Swedish East Asiatic Company, NORIN and his outfit were carried free in one of the Company's steamers from Gothenburg to Shanghai. On his way to Shansi NORIN made a point of staying for a while in Peking, where he could meet the most prominent geologists in China. Dr. V. K. TING, late Director of the Chinese Geological Survey, not only put the instruments and library of the Survey at NORIN's disposal, but had the benevolence and tact to print in the Bulletin of 1921 a welcoming greeting to ERIK NORIN, which recommendation was of great value, when we introduced the enterprise and our Institute to the Shansi authorities.

In Peking NORIN also met Professor J. G. ANDERSSON, who had served as Mining Adviser to the Chinese Government since 1914. He subsequently assisted our efforts by giving NORIN information about plant fossil localities and lending us expert Chinese collectors. It can be seen from the above that ERIK NORIN displayed both ability of cooperation, tact, energy and foresight, also in the preparation of his work in China.

Norin trains university students in geological field work.—He arrived in Shansi early in 1920 and did not wait long before starting field work in that province. He visited the unique mountain Tzu-Chin-Shan in the Western hills and collected material for describing the interesting alkaline rocks in that massive. This work resulted in our paper No. 1.

I had been somewhat anxious about his ability to carry on with practically no knowledge of the Chinese language. I remember how he replied on his return. "The country-people treated me as a son." Yes, they are no mean judges of human character, and they liked NORIN. The same can be said about the geology students of Shansi University, many of whom had their first training in field work just by him. Their gratitude was expressed by presenting him a large picture or scroll, made of red paper and with text in Chinese characters in black, the whole covering an area of several square metres (fig. 4). In the upper right-hand corner (see illustration) is NORIN's Chinese name, NA-LIN, and the students C. C. SUN, K. S. CHANG and S. L. TSAO have signed their names in the upper left corner. This honorary scroll can be seen in the attractive NORIN home in Uppsala. It was translated by Professor MINATO from Sapporo University, Hokkaido, N. Japan who visited Uppsala in 1959. Lack of space forbids us to translate the whole but the students express their regret at living so far apart now from their "esteemed and honoured teacher who is so well known in the Western countries. You were many years in China and have done extensive and successful field work. And we were happy to accompany you in this research work. But now unfortunately we are separated and sit below the

Fig. 4. Chinese scrolls dedicated to ERIK NORIN.

willow trees and drink our wine. And remember those wonderful days in Shansi and sincerely hope that you will some day return to China."

Norin superintends collection of Palaeozoic plant fossils.—In my "remarks", following the description of Shansi stratigraphy I have already mentioned the prevalence of plantfossils in certain formations, especially the Permian Shihhotse Series. Collections originate from this series, and there are rich localities near Taiyuanfu, both west and east of the city. Especially the latter, at the village Ch'en Chia Yü, where the villagers enthusiastically assisted the popular superintendent.

With the object of describing the fossils from the Shihhotse Series and determine their names, a great quantity (in no less than 184 packing cases) was sent to the State Museum of Natural History in Sweden and there examined, described and illustrated by Prof. T. G. HALLE of that museum, resulting in a magnificent volume called "Palaeozoic Plants from Central Shansi", published by the Geological Survey of China in 1927. Many new species were registered, and duplicates of the fossils sent to the Survey in Peking and to the new museum of Shansi University.

Norin plans and organizes a geological Museum in Shansi University.—When the many expeditions returned from the hills, they brought naturally a large number of specimens, not only fossils, but also rocks, representing the major formations of Shansi and other interesting types, for instance alkaline rocks from the many newly discovered localities. The need for a museum became urgent, and H. WANG, Dean of the Engineering Department of Shansi University, kindly allowed us to establish it in one of the large, well-lighted halls in one of the modern buildings of the university. We wanted to make the exhibition interesting and instructive, both for the students and the general public.

This was accomplished by NORIN in a simple but highly efficient manner. The entrance was from a corner in the hall, and proceeding from there along the walls, we started at the door with the oldest T'ai Shan formation and then, following the wall, there were rock specimens and fossils in ascending stratigraphical order and all well described in Chinese and English. The series finished with the youngest specimens, Pleistocene Loess etc. And in the middle of the hall were dozens of huge glass-cabinets exhibiting NORIN's Palaeozoic plant fossils, that is the duplicates mentioned above.

After three successful years in Shansi ERIK NORIN was invited by the famous explorer SVEN HEDIN to join his Central Asiatic expeditions, and sometimes, in HEDIN's absence, NORIN acted as his substitute and chief of the wide-spread enterprises.

It is time to close this chapter, and I do so with a greeting from no less a person than the great Confucius himself, the Master of *Ars vivendi*, or "Art of living", who still—after nearly 2500 years—exercises a strong and beneficial influence on the Chinese mentality. I received many years ago from the Chinese Legation in Stockholm a picture or scroll on red paper, with the three characters in black: "Jen Che Shou", which means "Kindness gives Long Life". I had helped one of their secretaries from Peking to Stockholm via Siberia, and this was the official recognition. Now I should like to convey this sentiment to ERIK NORIN and his family for their kindness and hospitality to me since my return to Sweden.