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No 1

S V E N H E D I N )

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by Georges de Roerich.

In the brilliant galaxy of Central Asiatic explorers two names stand foremost: Nicholas Prjevalsky and Sven Hedin. These names have become household words among all those interested in the advancement of geographical knowledge. Both of them in the course of their travels covered tremendous distances, and by force of their personalities, sound scientific method and literary gifts unfolded vast panoramas of scientific explorations. Thanks to their researches we possess now invaluable data on the heart of the Asiatic continent, and to them belongs the honour of discovering most of the outstanding orographical and hydrographical features of Inner Asia.

It is difficult to write about Sven Hedin, for vast are his explorations and innumerable his written works. For over thirty years he has laboured incessantly, and has created for himself an undying name in the Annals of Geography. His name is for ever connected with the solving of some of the most important problems of Central Asiatic geography : the exploration of the Tārīm, the Lop-nōr problem, the hydrography of the Tibetan highlands, and many of the great problems in the orography of Tibet and Eastern Turkistān.

Sven Hedin was formed as an explorer in the school of Ferdinand von Richthofen, that indisputable master of geographical research. It was during his studies under von Richthofen that Sven Hedin first conceived the plan of carrying out extensive explorations

in the remote and unknown regions of Central Asia. Dr. Hedin's first contact with Central Asia took place after a journey to Persia in 1890-91 where Hedin went as a member of the Embassy sent by King Oscar II to the Shāh of Persia. During this journey, he travelled through Askhābād, Merv, Bukhāra, Samarkand, Tāshkent, and Kāshgar, thus preparing himself for his future journeys. On his return journey he made a pilgrimage to Prjevalsky's tomb on the shores of the Issik-köl, and paid homage to the memory of his <sup>great</sup> predecessor. From this first contact with Central Asiatic soil begins his indefatigable activity as explorer, which brought fame to himself, and to his country - Sweden, which never failed to support the scientific projects of her illustrious son.

On October 16th, 1893, Sven Hedin began his first great journey across Inner Asia during which he conducted explorations in the Pāmīr, the Tārīm basin, the Lop desert, the northern Tibetan upland, southern Tsaidam, and the southern Gobi.

On the 25th of January, 1894, the explorer reached Tāshkent, where a stay was made to prepare the journey to the Pāmīr. On March 18th, Sven Hedin arrived at the Russian Pāmīr Post on the Murghāb. All through this journey the explorer carried out his physiographical observations, collected geological and botanical collections, took anthropological measurements, and carried out a route survey. From the Pāmīr he started for Kāshgar, and on the way made an attempt to climb the Muztāgh-atā ( 24,388 ft ), and mapped the lower part of the Prjevalsky Glacier. On February 17th, Sven Hedin left Kāshgar for Maral-bāshi, and on the 10th of April left the oase of

Meket-bāzār, south of Lailik on the Yārkand-daryā, with the intention to cross the desert towards the Khotan-daryā. It was during this strenuous desert march that he lost his camel caravan, and reached the dry bed of the Khotan-daryā on foot. His own life was saved by a water pool situated not far from the dry river bed. The loss of the caravan forced the explorer to return to Kāshgar, to equip another for his further work in the Tārīm basin. During the summer another trip was made to the eastern Pāmīr. On December 14th, Sven Hedin again left Kāshgar for Khotan following the southern caravan route. Khotan was reached on the 5th of January, 1895. After a stay in the oase, the explorer again left on a journey along the Keriya-daryā towards the Tārīm, whose course he followed eastwards up to the Lop basin. This first trip to the Lop-nōr inaugurated a series of investigations of this important problem, that were continued during the second great journey to Central Asia, and were finally solved during the recent Sino-Swedish Expedition. Dr. Hedin's observations during this first visit of the Lop basin substantiated the theory advanced by von Richthofen about the shifting of the lake. At the end of June, Sven Hedin left again Khotan on a journey to the North Tibetan upland, an exploration that resulted in a series of valuable observations on the eastern extension of the Kun-lun. He started his journey to the Tibetan highlands from Kapa, situated SW of Charchan. The Arka-tāgh was crossed over a Pass some 17, 000 feet high, situated some miles to the east of the Pass crossed by Littledale. From there, the explorer followed the western continuation of the Kokoshili range, and on his way discovered numerous self-contained water basins.

Because of the great altitude - some 16, 000 feet in average, the flora was scant and the region presented the appearance of an upland desert intersected by low rugged ridges. After crossing a second time the Arka-tāgh, Hedin penetrated the region of the riverhead of the Yang-tze, and especially that of the Nabchitu-mūren, a northern tributary of the Yang-tze. Then the Swedish explorer crossed the Tsagan-ūla range into the valley of the Tsagan-gol in the Tsaidam. Following the southern rim of the great salt marsh, Hedin visited the region of the lakes Kurlīk-nōr and Toson-nōr. From there through Dulān-khit and the northern shore of the Koko-nōr, the explorer reached Kumbum and Hsining-fu. Sven Hedin then journeyed across the Alashan and the Ordos to Pao-t'ou, and Peking, where he arrived on the 2nd of March, 1897. The rich results of this great journey were described in two volumes entitled " Through Asia " ( London, Methuen, 1898 ) which represent a masterpiece of scientific geography, and were acclaimed by such authorities as Sir Thomas Holdich ( Geographical Journal, 1899, p. 159 ), and Professor I.V. Mushketov ( Journal of the Imperial Russian Geographical Society, 1897, pp. 18-23 ).

The results of Dr. Hedin's investigations in the orography and hydrography of the region were published as a special issue of the Petermanns Mitteilungen under the title " Die Geographisch-wissenschaftlichen Ergebnisse meiner Reisen in Zentralasien, 1894-1897 " ( Gotha: Justus Perthes, 1900 ).

In 1899 Sven Hedin was again in the field preparing for another extensive journey in the Tārīm basin and Tibet. On July 30th, the explorer left Osh for Kāshgar. On September 5th he <sup>started from</sup> ~~left~~ Kashgar for Lailik on the Yārkan-daryā, from where he planned to start his journey along the Yārkan-daryā and the Tārīm, and for which purpose a boat had to be built. During the boat journey up to Yangi-kōl, where the explorer arrived on December 7th, a map was prepared of the river course. At Yangi-kōl, the camel caravan which was marching from Lailik joined the explorer, and a base camp was established, where meteorological observations were conducted throughout the stay. From his base camp at Yangi-kōl, Sven Hedin undertook a series of trips into the desert around the Lop basin. It was during one of these trips that he had the good fortune to discover the important ruined site of Lou-lan which flourished between 260-330 A.D. It was during a second visit to this site in March, 1901, that Hedin discovered numerous manuscript remains which have been now edited by the late Professor A. Conrady in his "Die chinesischen Handschriften und sonstigen Kleinfunde Sven Hedins in Lou-lan", Stockholm, 1920. On May 7th, Sven Hedin returned to his base camp at Yangi-kōl, and resumed his boat journey down the Tārīm, which continued as far as Abdal. The result of this boat journey was a complete mapping of the river course..

On July 13th the whole caravan was assembled at the riverhead of Mandarlik on the Tibetan upland. A base camp for the Expedition was established at Tumorlik, situated west of the lake Ghāz-kōl.

From here Sven Hedin with a small caravan undertook a journey into the Central Kun-lun and crossed the Chamen-tāgh, the Arka-tāgh over a Pass 16,996 feet high, and the western continuation of the Kokoshili range. This journey included much of previously unmapped territory, and Dr. Hedin explored numerous lake basins situated in Latitude 34 N and Longitude 90 E. This trip took three months to complete and cost the life of one of the caravan followers and of several pack animals. This journey into the Central Kun-lun was followed by a trip to the lake Kum-k'ól, and an exploration of the Serthang uplands. Then the explorer crossed again into the Tārīm basin and returned to the Lop desert. He mapped the old river channel of the lower Tārīm, and came to the conclusion that the entire Tārīm had formerly occupied this old river bed. Careful leveling discovered the existence of a broad shallow depression with an old shore line not far from the ancient site of Lou-lan. On April 8th, Sven Hedin returned to Charkhlik, and on May 17th the explorer left this base on another expedition to the Tibetan upland following the route along the Charkhlik-su. The large caravan of the expedition assembled again at the Kum-k'ól, and from here started southward across the upland of Northern Tibet. On July 27th, the explorer decided to attempt to reach Lhasa, the capital of Tibet, in the disguise of a pilgrim. Leaving his large caravan, he started with two followers. On August 1st, he reached the Sa-jyu tsang-po, but four marches south of the river he was stopped by a strong detachment of local Tibetan militia. The

explorer was forced to return to his caravan. The southern point reached during this attempt was Bum-tsho ( Latitude 31 40 N and Long. 90 45 E ). Far from being discouraged, the explorer made another attempt, and on August 25th reached the lake Ziling-tsho, but was again stopped by the watchful frontier guards, and decided to turn towards Ladak. During the long march to Leh across the desert uplands of Western Tibet, where frequent absence of water, and continuous storms make the journey extremely difficult. Sven Hedin's route crossed several times the routes followed by Nain Singh and Littledale. His explorations of the lakes on this journey across the northern sections of Nam-ru, Nag-tshang, and Nga-ri threw new light on the physiography of this important region of Central Tibet. On December 13th, 1901, the explorer reached Leh in Ladak. After a brief stay in India, Hedin returned to Leh and on April 5th, 1902 started for Kāshgar by the Karakorum route. Kāshgar was reached on May 14th. From there the explorer journeyed to Andijan on his homeward journey across Russia. The scientific results of this expedition were described in six large volumes, and two volumes of maps, entitled " Scientific Results from a Journey in Central Asia, 1899-1902 " which form a fitting conclusion of this great undertaking in the heart of Asia. Perhaps the most important of Sven Hedin's journeyes, was his third great journey to Tibet which resulted in a series of brilliant discoveries. In the second half of 1905, the great explorer

started on another journey to Tibet, to explore the upper Indus region, the Tsang-po basin and the Region of the Great Lakes in Central Tibet, the northern section of which the explorer visited during his Expedition of 1899-1902. Starting from Ladak, Sven Hedin reached the upland plains of Ling-tse thang and Aksaichin, crossing a Pass some 19,500 feet high. In October, the explorer conducted explorations with the help of a collapsible boat on the highland lakes of Yishil-k'ol, Ligden, and Bul-tsho. December was spent on the lake Dumbuk-tsho, and in January, the explorer made a fruitful stay on the shores of the important lake Ngantse-tsho, discovered by Nain-Singh. After crossing several important mountain passes, with an average altitude of 18,000 feet, the explorer reached the Brahmaputra at Yeshung. From there he reached Shigatse on the 9th of February after a four days journey down the Tsang-po. This journey along the great river of Tibet resulted in many interesting observations as to the role of the Tsang-po valley in the physiography of Tibet: "The air, the water, and the solid material, everything is wandering from West to East through this great furrow between the Himalayas and Trans-Himalayas. The Tsang-po is the great recipient for Wind, water, and detritus" (Hedin: Southern Tibet, vol. II, ch. XLIV-L, p. 300). At Shigatse, Sven Hedin was met by officials from Lhasa who carried strict orders to stop the explorer at Ngantse-tsho. During this remarkable journey across the uplands of Western Tibet, the explorer determined hypsometrically 200 points, mapped on 230 sheets of maps and an almost unexplored stretch of territory, made important observations on the physiography of the traversed region. On March 27th, Sven Hedin left Shigatse on another journey across the uplands of

Western Tibet. In August he carried out explorations in the region of the Manasarovar lake, and on September 10th, 1907, had the fortune to discover the source of the Indus. On the 28th September, the explorer reached Gartok, and on November 26th the expedition arrived at Thangtse on the Ladak border. Here another caravan was equipped for another trip across the Tibetan upland. During this second journey, the eminent explorer crossed the Tibetan upland by another route in a SE direction, and succeeded in reaching Raga-tasam on the Tsang-po, where he was stopped by the authorities of Sagā-dzong. This second crossing of the Tibetan upland, Sven Hedin carried out in the disguise of a Ladakī trader. On his return journey, the indefatigable explorer carried out explorations in the previously unexplored region of Bong-ra. Sven Hedin gives us a striking picture of the uplands of Western Tibet : " The landscape is typical, showing the levelling action of a denudation that has been going on for long periods. Here, as in many other places of interior Tibet, we have indeed a very good example of what Penck calls the " upper denudation limit " above which the destructive action does not allow any mountains to rise. The panorama also very clearly shows how the different ridges ... are cropping out from the debris which form very flat conical screes sloping extremely slowly from the base of the mountains down to the midst of the plains or latitudinal valleys. The depressions and cavities between the mountains which have been filled up with enormous quantities of loose material, occupy a much greater area than those parts which, still, in the form of mountains, rise above the beds of

deposits... The relative heights ... in the course of time decrease. The procedure is irresistible and uninterrupted, though, of course, extremely slow .... The final result at which the destructive powers are aiming, is to bring the mountains and the valley plains at one and the same level. This would be the ideal plateau-land, a status which, however, never will be reached, for the peripheric erosion is with the same energy working its way towards the heart of the still self-contained plateau-land without outlet to the Ocean " ( Hedin, Southern Tibet, vol.II, ch. XIX, p. 262 ). The return journey was effected through the Suttlej valley, and Simla was reached early in September, 1908.

This tremendous journey brought significant results, the most outstanding of which are the discovery of the sources of the Indus and of the Brahmaputra ( Tsang-po ), and the discovery and survey of the great mountain range north of the Tsang-po, to which the explorer himself gave the name of Trans-Himalayas, but which is called by many the Hedin Range ( Cf. Leuchs, Zentralasien, Handbuch der Regionalen Geologie, Heidelberg, 1916, p. 118 ). Dr. Sven Hedin was the first to survey the range and cross it by at least eight tremendous mountain passes with an average height of 18, 000 ft. During the journey twenty high snow peaks were determined trigonometrically, and the highly intersected region mapped. The range forms the watershed between the Indian Ocean and the enclosed self-contained drainage region of Inner Asia. In the West the Trans-Himalayas stretch towards the great Karakorum range, which has a similar structure. To the East it merges with the Nyen-chen Thang-la, and

thus forms the most outstanding feature in the orography of Tibet.

Hedin's exploration of the lakes of the Tibetan upland furnished new and important data towards the solving of the problem of the dessication of Inner Asia. His survey filled in a large gap in the map of Tibet, and traced the main outlines of this elevated region.

The scientific results of this Expedition were embodied in nine large volumes entitled " Souther Tibet. Discoveries in Former Times compared with my own researches of 1906-1908 ", Stockholm, 1917-1922. The publishing of this sumptuous edition is by itself an event of the first magnitude in the history of the geographical exploration of Asia, and will remain for ever a monument of scholarly acumen, and an example of exploratory method #).

For many years the eminent explorer had in mind a thorough exploration of Central Asia by a group of scholars belonging to different branches of science. Such a new type of expedition answering the requirements of modern research and the growing demand for specialization has long been a necessity. This new type of expedition tends to enlist a group of specialists, each in charge of his own field of research; moreover, it tends to develop into a moving research station whose research workers spend a considerable time in one region, and establish research bases at various points within the region of exploration.

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#) The eminent French geologist M. Emmanuel de Margerie has recently published a brilliant account of "Southern Tibet", entitled "L'Œuvre de Sven Hedin et l'orographie du Tibet", Paris, 1929.

This new type of expedition facilitates the accumulation of exact data on the country and provides the scientists with a unique opportunity to test and verify their results.

In May, 1927 such an expedition, officially known as the Sino-Swedish Expedition, took to the field under the leadership of Dr. Sven Hedin. The Expedition consisted of twenty-eight members, and included several well-known Swedish, German and Chinese scholars. A significant characteristic of this great scientific enterprise was its close co-operation with Chinese scholars, who contributed greatly to its success. At the outset the Society for the Preservation of Cultural Objects, a learned body in Peking ostensibly in charge of scientific activities throughout China, attempted to hinder the progress of the Expedition. After protracted negotiations Dr. Sven Hedin succeeded in signing an agreement which enabled the Expedition to start into the field. It was a considerable victory in the face of a stubborn opposition, and a general anti-foreign attitude, from which many recent expeditions had to suffer. The scientific staff of the Expedition consisted, besides the Leader, of Dr. Erik Norin, geologist, and well-known for his explorations in China and the N.W. Himalayas; Dr. Folke Bergmann, archaeologist, and Dr. Waldemar Haude, meteorologist. Besides the above the Expedition had eight German members, all of whom actively participated in the exploratory work and assisted the scientific staff in the carrying out of their manifold duties. The Chinese section of the staff consisted of Professor Siu Ping-Ch'ang, co-leader of the Expedition, Professor F. L. Yüan, paleontologist, Mr. W. Huang, archaeologist,

x) A general account of the Expedition is given in Dr. Hedin's *Across the Gobi Desert*, London, Routledge, 1931.

Mr. T. H. Ting, paleontologist, and several collectors and assistants. Mr. J. A. Larson, well-known throughout the Sino-Mongolian borderland, and once adviser to President Yüan Shih-k'ai, was in charge of the large expeditionary caravan. The Expedition had an extensive scientific programme before itself. Besides topographical work, in which most of the Expedition members participated, one of the chief problems of the Expedition was to be carefully conducted meteorological observations. It was Dr. Hedin's plan to establish permanent meteorological stations, equipped with up-to-date equipment, at different points along the route, and thus obtain a full record of atmospheric changes in the desert regions of Inner Asia. These careful meteorological observations, supplemented by geological investigations, and search for Quaternary deposits, had as one of their chief objects the solving of the problem of dessication of Inner Asia, and the sequence of climatic changes, not to speak of the great practical importance of meteorological work in a region where all previous observations had only a sporadic character. It was proposed to establish four meteorological stations of a more or less permanent character, and manned by Chinese assistants specially trained for this kind of work. At such stations observations could be conducted for considerable periods of time and thus furnish invaluable information. Ordinary meteorological observations were to be conducted throughout the journey. The first station was to be established at the Etsin-gol; the second at Hāmi on the Hsin-chiang - Kansu border; the third at Urumchi, capital of Hsin-chiang lying north of the T'ien Shan; the fourth at either Charkhlik or Charchan on

the southern rim of the desert. A fifth station was planned on the Khotan-daryā, not far from the place where Sven Hedin lost his caravan during his memorable expedition of 1894-97. Dr. Erik Norin, the geologist of the Expedition, intended to survey the route across the Gobi, and then make a special study of the Quaternary geology of the Kuruk-tāgh range and of the Lop basin. Dr. Folke Bergmann had a vast field before him, with special instructions to search for pre-historic sites in the Gobi and Hsin-chiang, and the study of tribal movements during the prehistoric periods within Central Asia. Anthropological investigations and measurements were to be conducted throughout the journey. The botanical and entomological collections were in charge of Dr. Hummel, medical adviser to the Expedition. On the 20th of May, 1927, Dr. Hedin accompanied by Dr. Hummel left Pao-t'ou for Pei-ling miao in Inner Mongolia, where the camel transport of the Expedition had orders to assemble. The other members of the Expedition in charge of the different columns were instructed to reach there from Khalgan and Kuei-hua ch'eng. The Expedition camp was established on the Khujirtē-gol, a river flowing West of the monastery of Pei-ling miao. Here the Expedition stayed until July 22nd organizing itself and awaiting the camel transport. On the 29th July the whole caravan left the camp at the Khujirtē-gol, and proceeded westward by the desert route to Hāmi. Their immediate objective was the Etsin-gol. The Expedition proceeded in three columns: Dr. Norin's column chose a slightly northern course; Dr. Hedin with the main column followed a middle course, keeping communication with both the northern and southern columns of the Expedition, the latter under Prof. Yuan.

Near Tsagan-obo sūma, Dr. Bergmann discovered an important prehistoric site, and collected some 1480 stone artifacts, and fragments of ceramic. On the 16th August, the Expedition reached the monastery of Shande-miao, situated in the Khara-narin-ūla. After a stay of several days, the Expedition started again on the 29th August, and after a strenuous march reached on September 28th the Etsin-gol. Here a prologued stay was imperative to carry out the extensive scientific programme, to establish the first metereological station and prepare for the next desert crossing to Hāmi. During the stay at the Etsin-gol the following programme was carried out:-

- (1) Survey of the Gashun-nōr and Sokho-nōr basins.
- (2) Archaeological investigations along the river course and the lake basin.
- (3) Search for a ruined city situated in the desert West of Gashun-nōr.
- (4) Survey of the Etsin-gol.
- (4) Visit to the ruined city of Khara-khoto.

The first metereological station was duly established and placed in charge of Major Zimmerman, and a Chinese assistant. Both of them lived through a remarkable <sup>experience</sup> ~~adventure~~. While working at the Etsin-gol station, Dr. Hedin and the metereologist of the Expedition decided to establish a station at Pao-t'ou, to be the first link in the chain of projected metereological stations. For this purpose one of the Chinese assistants was deputed to Pao-t'ou with adequate equipment to start the station.

On the 28th October the Expedition was rejoined by Dr. Norin and

Dr. Bergmann. Dr. Norin during his trip across the Gobi carried out a careful survey based on triangulation through country previously unmapped. Dr. Bergmann succeeded in discovering about 120 neolithic sites between Pei-ling miao and the Etsin-gol. Most of these sites were found to be situated along old water courses.

Dr. Haude left the camp at the Etsin-gol on the 31st October and proceeded westward towards Hāmi, to establish the station No. 2. The main column of the Expedition under Dr. Hedin started only on November 8th, and chose a northern course, lying WNW of the Gashun-nōr. The advance column of the Expedition were unable however to enter Hsin-chiang, and establish the second meteorological station at Hāmi. The provincial authorities at Urumchi ordered the frontier officials at Hāmi to arrest and disarm the Expedition which was taken for an advance guard of an army advancing from Kansu. After negotiations, the Expedition was permitted to journey to Urumchi on the condition of delivery of fire-arms and ammunition, servants and camels to remain at the frontier, and that members should abstain from taking photographs and route surveys. On the 4th February, the Expedition left Hāmi for Urumchi. While passing through Turfān, Dr. Hedin heard that the Tārīm had recently changed its course, and was flowing now in the old river channel of the Kuruk-daryā or Kum-daryā towards the old Lop-nōr. This return of the river to its northern bed was indeed indicated by Sven Hedin as far back as 1900/1901 ( Cf. Hedin: Scientific Results of a Journey in Central Asia, 1899-1902, vol. 2, p. 355 ). It was decided to do the utmost to obtain permission from the provincial authorities to study the new important changes in the <sup>Lop</sup>~~Lop~~ basin.

On February 27th, the Expedition arrived at Urumchi.

A tactful handling of the difficult situation, gained for Sven Hedin and his scientific collaborators the goodwill of Governor Yang, and made the continuation of their scientific work possible. A meteorological station was established at Urumchi, and another mountain station was equipped on the Bogdo-ūla at an altitude of some 8600 feet. Dr. Norin was enabled to proceed with his researches in the Kuruk-tāgh mountains and the Lop-nōr.

On the 4th of May, Sven Hedin left Urumchi for Europe accompanied by four of his German collaborators. The vast enterprise required new negotiations in Europe and China, new equipment had to be procured and plans fixed to insure the continuation of the scientific work. Professor Siu Ping-Ch'ang and Major Hempel remained in Urumchi in charge of the Expedition headquarters.

On July 7th the Expedition lost a well-wisher in the person of Governor Yang Tseng-hsin who was treacherously murdered by the escort of the Foreign Affairs Commissioner Fan Yao-han. The immediate successor of Governor Yang did not quite understand the scientific aims of the Expedition, and although the various units were permitted to carry on their work, the activities of the Expedition were constantly hindered by local authorities.

On August 8th, 1928, Dr. Sven Hedin accompanied by a new member Dr. Nils Ambolt, astronomer, left Stockholm, and on the 3rd of September reached the frontier town of Chuguchak. On his return to Hsin-chiang, the Leader of the Expedition at once discovered the changed attitude towards the Expedition, and the necessity

of further negotiations with the Nanking authorities. Notwithstanding petty misunderstandings and attempts to stop the scientific work for good, the members of the Expedition bravely kept to their work. The vast field necessitated new members to be drafted into service, and for this, permission had to be obtained from the central authorities in Nanking. On December 17th, Dr. Sven Hedin started on another trip to Peking accompanied by Dr. Hummel, Dr. Bergmann, and Professor Siu Ping-Ch'ang. Negotiations in Peking and Nanking ended with extremely satisfactory results, and the Expedition was permitted to continue its scientific work in Central Asia. It was Dr. Hedin's plan to rejoin his expedition in Hsin-chiang, and to follow on his return journey the motorable route from Khalgan, Urga, Uliassutai, Khobdo and Urumchi. However, disturbed political conditions in the region prevented him from following this route. In May, Dr. Hedin fell ill, and after an examination at the Peking Union Medical College, the doctors established the necessity of an operation, and of an immediate journey to Boston to consult the well-known specialist Dr. Harvey Cushing. Thus the headquarters of the Expedition were unexpectedly transferred to the United States. It was during this stay in the United States, that Sven Hedin met with Mr. Vincent Bendix, the Chicago industrialist. The result of this meeting was the significant decision made by Mr. Bendix to finance an ethnographical unit of the Sino-Swedish Expedition for the purpose of bringing back a complete Lamaist

temple to Chicago, and one Stockholm, together with collections of ethnographical objects. After a journey to Stockholm full support was obtained from Swedish authorities, and on the 31st September, Dr. Hedin was able to leave Stockholm accompanied by Dr. Hummel and Dr. Goesta Montell, ethnologist. During his passage through Moscow, the explorer met with the eminent Swedish archaeologist Dr. T. Arne, and outlined with him a programme of archaeological explorations in Russian Turkistān to begin in February, 1931. This archaeological exploration was to supplement the researches of Dr. Bergmann in Eastern Turkistān and the Gobi. While Dr. Hedin was thus busy organizing, lecturing, enlisting new support, and attending to all the manifold needs of his "travelling university", Dr. Norin, assisted by Dr. Ambolt, was conducting his researches south of the T'ien Shan; Dr. Haude was supervizing the work of the several meteorological stations established in Hsin-chiang, and Professor Yüan was continuing his paleontological explorations in the eastern T'ien Shan.

On his arrival in Peking, Dr. Hedin learned the good news that the new members of his Expedition, headed by Dr. Bergmann were ready to start across the Gobi, and were encamped at Pei-ling miao. The new collaborators were Dr. Nils Hoerner, geologist, Dr. Bernhard Bexell, paleontologist, and Dr. Birger Bohlin, paleontologist, who distinguished himself in the service of the Geological Survey of China. The Expedition was fortunate in acquiring all necessary equipment from Dr. R. C. Andrews, who was prevented by the Chinese authorities from continuing his work in 1929.

On the 30th of October, Dr. Hedin left Peking for Pei-ling miao in Inner Mongolia, and on the 11th November the new members of the Expedition started on their long track across the Gobi. Dr. Hedin accompanied by Dr. Hummel and Dr. Montell made a motor journey across Inner Mongolia to survey the possibilities of acquiring a temple for Chicago and Stockholm. On completion of this trip, the Expedition headquarters were transferred for a couple of months to Khalgan. Dr. Montell accompanied by Mr. Larson proceeded to Jehol to continue his survey of Buddhist temples. In December the headquarters were visited by Dr. W. Haude, the meteorologist of the Expedition, who had attempted to journey from Hsin-chiang across Kansu, but was refused permission. Plans were worked out to resume this important work in 1931, and to establish meteorological stations in NE. Tibet and the Nan Shan.

In October, 1930, the Expedition consisted of the following units:-

1. Geological and geodesic unit under Dr. Erik Norin and Dr. Nils Ambolt, working in the Tārīm basin.
2. Archaeological unit under Dr. Bergmann assisted by Dr. Bernhard Bexell, paleobotanist. Region of exploration : Kansu and the Gobi.
3. Geological unit under Dr. Birger Bohlén and Dr. Nils Hoerner, assisted by the geodesist Chen. Region of exploration : Kansu and the Gobi.
4. Zoological and botanical unit under Dr. Hummel, assisted by Manfred Boekenkamp and Mr. Hao. Region of exploration: Ssu-ch'uan and the Sino-Tibetan borderland.
5. Ethnographical unit under Dr. Goesta Montell, assisted by Mr.

George Soederbom. Region of exploration : Jehol and the adjacent districts of Inner Mongolia.

Besides the above, three other units were planned for 1931:

386 6. Metereological unit under Dr.W.Haude. Region of exploration: NE.Tibet and the Nan Shan.

7. Archaeological unit under Dr.T.Arne. Region of exploration: Russian Turkistān.

8. Botanical unit under Dr.Harry Smitt. Region of exploration: the Himālayas.

In June, 1932, the papers announced the return of the Expedition to Peking, and it is hoped that some of the outstanding results will be soon made available. The scientific study of all the collected data will take many years to complete.

Dr.Norin's explorations will certainly throw new light on the geology and physiography of Inner Asia. His careful topographical surveys, with their wealth of geological data, will form an outstanding contribution. The route across the Gobi traversed much of previously unmapped territory, and Dr.Norin's route survey from Pei-ling miao to Shande miao ( 24 sheets of map, scale 1 : 50,000 ), and from the latter point to the relay station of Sebistei in the SW Gobi ( scale 1: 100,000 ) will be of special value. During the Expedition's stay in the basin of the Etsin-gol, Dr.Norin made a thorough survey of the Hashun-nōr and the Sokho-nōr lakes and the ancient shore lines. His exploration in the Kuruk-tāgh and the region of the Baghrash-kōl, have yielded rich results. The Kuruk-tāgh which tectonically belongs to one system with the T'ien Shan was found to have served

as a refuge for fauna and flora, and no evidence of Quaternary glaciation were discovered. The exploration of the ancient Lop basin has given a new picture of Quaternary conditions in the basin, and the survey along the foothills of the Kuruk-tagh, has shown that the Quaternary lake must have had a considerable depth in its NW section, whereas its eastern portion had been shallow and swampy. During his trip to the Lop basin in April, 1928, Dr. Norin found a rich vegetation and animal life along the new river bed. The Kuruk-darya presented a big river about 300-400 feet in width and about three feet deep. It was carrying its waters towards the ancient historical Lop-nor, bringing life into a dismal salt-crusted desert. We have already mentioned in the present article, that the recent change of the lower Tārīm course, had been predicted by Dr. Hedin some thirty years ago. During his first expedition to Central Asia, the explorer followed the eastern bank of the Tārīm, and had discovered that it turned in a south-east direction and emptied itself into a large lake with swampy shores in the southern part of the Lop desert. This he identified with the Lop-nor lake described by General Prjevalsky who visited the lake during his memorable journey of 1876/77. Dr. Hedin discovered north of the lake an old river channel, which he carefully surveyed during his second great expedition of 1899/1902. His study of the locality convinced him that the entire Tārīm had once occupied this old river bed. The discovery of the ruined site of Lou-lan only confirmed his conclusion, and in his monumental "Scientific Results of a Journey in Central Asia"

( vol.2, p.355 ) he made the following significant statement:  
" In the light of knowledge we now possess as to the relations of level that obtain in the desert of Lop, it is not too bold a thing to say, that some time the river ( Tārīm and its tributary the Konche-daryā ) must go back to the Kuruk-daryā".  
The mapping of the new lower course of the Tārīm and of the present Lop-nōr was continued by Dr. Nils G. Hoerner, and some of his results are vividly told in his article : Upp-tackten av nya Lop-nōr ( Ymer, 1931, pp.344-378 ). Dr. Norin's survey south of the T'ien Shan in the region of Baghrash-kól is of the greatest interest ( survey of over 2000 square kilometers, map scale 1 : 100,000 ). In this exploration Dr. Norin was accompanied by Dr. Nils Ambolt, who determined with the Invar pendulum the gravity of many places in Eastern Turkistān, and whose geodetic reaserches in the region are of the greatest interest.

During the autumn and winter of 1930, Dr. Norin conducted explorations along the foothills of the Kun-lun. The object of this exploration was a search for Quaternary deposits and the determination of the rate of recension of the late Quaternary glaciers. The region between Khotan and the Sanju river was found particularly rich in typical morainic deposits .  
Dr. Norin's explorations in the Tārīm basin have given definite proofs of important orographical and climatic changes during and after the Ice Age, when the glaciers of the Kun-lun extended far into the Tārīm basin and formed large piedmont glaciers

at the mouths of the valleys. These researches have thrown new light on the problem of the Ice Age in Central Asia, and the subsequent dessication of the region.

Dr. Folke Bergmann's researches in the prehistory of the Gobi and of Eastern Turkistān have added considerable to our knowledge of the prehistory of Mongolia and Turkistān. About 103 stone age sites were discovered along the route from Peiling miao to Shande miao; 19 sites between Shande miao and the Etsin-gol, and seven along the desert route between Etsin-gol and Hāmi. Several important sites were discovered in the Kuruk-tāgh mountains with an interesting ceramic similar in character to that of Kansu and Honan. All this huge material will have to be studied in connection with the already known prehistoric finds in Mongolia ( the paleolithic sites of the Ordos discovered by the French Jesuits, Rev. Teilhard de Chardin and F. Licent; the recent researches of Prof. B.E. Petri in Transbaikalia and the Kosogol region of Northern Mongolia; the finds of N.C. Nelson, of the R.C. Andrews Expedition, and the rich documentation gathered at the Museum of the Mongol Scientific Committee at Urga), and those of Eastern Mongolia, Jehol and Southern Manchuria ( the explorations of R. Torii ).

In the Kuruk-tāgh were discovered many rock drawings of the familiar type found in Russian Turkistān, South Siberia, Mongolia and Western Tibet #).

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#) Cf. G. de Roerich, Problems of Tibetan Archaeology, Journal of the Urusvati Himālayan Research Institute, vol. I, p. 31.

Stone graves were found in many localities along the route, and some of them opened, but yielded no finds ( this is a characteristic case with graves of this type in Mongolia and Tibet. The inventory of such empty graves must have been destroyed by field rodents. Frequently metal objects belonging to the inventory of such graves have been found at considerable distances in rat holes. Cf. Roerich, The Animal Style among the nomad tribes of Northern Tibet, Prague, 1930, p. 12 ).

In autumn of 1928, Dr. Bergmann accompanied by H. Haslunf made a journey to <sup>the Tibetan upland</sup> ~~Charkilik~~ and visited the upper course of the Charchan-daryā and the adjacent region. The region was found devoid of any archaeological remains. During this trip an ethnographical collection was made, and anthropological measurements carried out.

During his second trip across the Gobi, Dr. Bergmann had the good fortune to discover over 10, 000 inscribed wooden tablets of the early Han epoch at the Etsin-gol. This important discovery of Han documents is the largest of its kind, and the material will be studied by Professor Bernhard Karlgren of Goeteborg, and Prof. Lui Fu of Peking. The whole collection will be preserved in Peking. Besides these Han documents, the Expedition discovered several hundreds of funeral inscriptions of the V-VII-th centuries AD., and numerous inscriptions of the Mongol epoch.

The important work by Dr. Waldemar Haude was already referred to in the course of the present account. Dr. Haude started his systematic observations on March 30th, 1927 in Pao-t'ou, and

continued them throughout the Expedition until autumn, 1929. The vicissitudes of the present unrest in China brought many changes in the programme of meteorological observations. The first station was established at the Etsin-gol on October 1st, 1927. The station at Hami did not materialize due to local conditions and war danger along the Hsin-chiang- Kansu border. The station at Urumchi was established on January 22nd, 1928, and a mountain station was established on the Bogdo-ūla at an altitude of about 8,600 feet. A third station was established at Charkhlik on June 22nd, 1928 with a mountain station. The fourth station was established at Kuchā on June 30th, 1928, with a branch station in the mountains. During the fieldwork, Dr. Haude sent up 353 pilot balloons to a maximum altitude of 21,000 meters. The various records kept by these stations will certainly give an entirely new picture of atmospheric conditions in the Central Asiatic desert region. Dr. F.L.Yüan, the archaeologist and paleontologist of the Expedition, made some important discoveries of 58 stone age sites in the Gobi, while he was in charge of the southern column of the Expedition. His most important find was the discovery of ~~Dinosauria~~<sup>4</sup> remains in the eastern T'ien Shan. Besides his paleontological work, Prof. Yüan made a thorough survey of the region round Ku-ch'eng.

Mr. T.H.Ting, paleontologist, conducted explorations in the western part of Eastern Turkistān, especially in the central and western portions of the T'ien Shan, Kāshgar, and Sarīkol. The archaeological collector Wang was working in the western part of Eastern Turkistān.

The ethnographical unit under Dr. Montell has been busy working in Inner Mongolia and Jehol. In the summer of 1930, Dr. Hedin accompanied by Dr. Montell, Mr. Soederbom, and a Chinese architect Mr. W. H. Liang made a trip to Jehol. After inspecting the temples, they decided on the famous Golden Pavillion built by Ch'ien-lung in 1761-1771 A.D., and Mr. Liang took the necessary measurements, drew the plan, and profiles of the temple, as well as prepared in colour sketches of all decorative patterns in the ornamentation of the temple. On return to Peking the various parts of the Golden Pavillion were duplicated by Chinese carpenters. More than 28,000 parts were shipped to Chicago where they arrived in the spring of 1931. Dr. Montell also sent his large collection of Buddhist images, and cult objects and monastic garments. Another large collection was sent to Stockholm where an exhibition was opened in January, 1932, and occupied eleven exhibitions halls. Mr. V. Bendix placed the Pavillion and the collections at the disposal of the Centenary of Progress Exhibition. The reproduction of the temple was erected under the supervision of Donald Boothly, architect, assisted by Mr. Yüan Hsi-kuo. After the Exhibition the temple will be removed to Lincoln Park.

Such is the story of this vast scientific undertaking which for almost five years conducted scientific explorations in various parts of Inner Asia. Central Asia was never an easy field of scientific research, and the difficulties did not become lighter in recent years. Political unrest in adjacent regions penetrated the deserts and mountain solitudes of the heart of Asia, and it

is with deep admiration that one looks on this band of brave men who conquered dangers and obstacles under the inspiring guidance of their great Leader - Sven Hedin, whose name is for ever connected with the highest mountain ranges of Asia. During the Roerich Central Asiatic Expedition of 1925-28, the writer had on many occasions crossed the routes of Sven Hedin, and it is a pleasure to record here the general esteem in which the name of the great Swedish explorer is held in many a remote place of Inner Asia. The new generation of explorers, always eager and enthusiastic to follow the path of their great predecessors, will find a source of constant inspiration in this great epopee of Sven Hedin.

Georges de Roerich.