BARON FERDINAND VON RICHTHOFEN

BY SVEN HEDIN

The 5th of May this year the Centenary Anniversary of Ferdinand von Richthofen was celebrated in all the geographical and geological institutions of Germany and probably of many other countries. For he was not only the greatest authority on modern physical geography of his time, but also the founder of our knowledge of the geology of China. In the first volume of his monumental work "China", one of the great milestones in the history of geography, Richthofen has, with the hand of a master, drawn up the gigantic features of the geography and morphology of Asia that can hardly ever be surpassed.

Ferdinand von Richthofen was born, May 5th 1832, at Karlsruhe in Silesia. Having finished the school he studied at the universities of Breslau and Berlin, and, in 1856, he carried out a geological survey of south-eastern Tyrol. During the following four years he took part in the work of the Geological Reichsanstalt of Vienna. With the quality of an expert on geology and with the title of a Secretary of Legation he was a member of the Prussian expedition to Japan, China and Siam, and travelled also in Java, the Philippines and the Further Indian Peninsula after which he worked in California and Nevada.

In 1868 Richthofen went to Shanghai and sacrificed four years of his life to the geological exploration of China Proper, where he travelled through eleven of the eighteen provinces, and to some parts of Japan. The Chamber of Commerce of Shanghai contributed largely to the expenses of his exploration. The eleven letters or reports he sent to the Chamber are still regarded as a standard work, and his thorough description of the trade routes proved to be of very great value to the commerce of 1870 and later years.

At the end of 1872 he returned to Berlin and began to work out the rich results of his exploration. In 1875 he began to teach geography as a professor at the university of Bonn. From 1883 he occupied the same chair...
at Leipzig and from 1866 to his death at the university of Berlin. During several periods (1873-75, 1880-90, 1892-94 and 1898-1900) he was president of the Geographical Society of Berlin. He was also Director of the Institute of Oceanography, founded in 1902, and published its records. He died at Berlin October 5, 1905.

During the 65 years which have passed since Richthofen began his pioneer geological work in China the geological structure of this enormous country has been thoroughly studied by scores of Chinese and western geologists and our knowledge of it has made tremendous progress particularly after the foundation of the Geological Survey of China under its leaders, Dr. V. K. Ting and Dr. Wong Wen-hao. Most of Richthofen's great epoch-making discoveries have proved to be correct, others have been improved or explained in a different way according to the irresistible development of science in later years. In his great work, "China" for instance, he distinguished a formation series of old stratified rocks as the Sinian Series which he regarded as being a part of the foundation of China's mountainous architecture. However, his Sinian formation also included some younger strata which in reality belong to the Cambrian period. Professor A. W. Grabaub has therefore proposed the term Sinian should be limited to the pre-Cambrian formations which by other authors are called Proterozoic, Algokinian, etc. According to Grabaub the term Sinian should be introduced as belonging to the whole earth equivalent with the terms for younger formations such as Cambrian, Silurian, etc.

As another example of Richthofen's pioneer work it should be remembered that he, on one of his journeys from Manchuria to Chihli, at Kaiping found a rich Carboniferous field which indeed was an important discovery to science. At his time, more than 70 years ago, the coal was broken in a primitive way, but later on rich coal mines were opened at this place and worked according to modern methods. The geology of the Kaiping basin was, in 1914, investigated by Professor J. G. Anderson who then corrected Richthofen's conception of the geology of this region.

A discovery which more than anything else made Richthofen's name famous widely beyond the purely geological circles of scholars, was the per-
spicuous and clever interpretation he gave to the formation of loess covering as being an Eolian deposition, dust carried by the wind and at certain places, especially in Karas, Shenxi, Shanxi and Huanan, falling down and forming deposits on the earth's surface. According to Richthofen great quantities of dust were brought by the winds from the enormous desert regions in the interior of Asia and were deposited mainly in valleys and basins where the wind velocity was insignificant, and here they were, in course of centuries, deposited to a layer of great thickness which often covered the underlying ground entirely, a phenomenon that took place during a period when a steppe climate predominated in North China.

The correctness of Richthofen's theory of the loess as being an Eolian formation was shown by the existence of land molluscs and other non-aquatic remains in it, and his theory could not be improved by later scholars. He only overestimated the thickness of the loess layers estimating them to 400 m, which, in Shenxi and Karas, has been reduced to one fourth by Prof. Andersson. From the typical Eolian loess he distinguished a "Lake loess" which had a horizontal structure and was regarded by him as deposited in lakes.

The title of Richthofen's standard work, (China, Ergebnisse seiner Reisen und darauf gegründeten Studien, Band I, einleitender Teil, Berlin 1877), the most remarkable and epoch-making ever written on the geography of Asia, points out the difference between it and its two great predecessors, Ritter's "Asien" and Humboldt's "Asie Centrale". It is all built up on his own personal observations so far as China and many other parts of Asia are concerned. Ritter and Humboldt had to work their hard ways through heaps of documents. And still no other works have in the same degree developed geography to a science, all over the world. The third great German Asiatic scholar, Ferdinand von Richthofen, was greater than his two countrymen. For, while there chiefly were compilers, Richthofen was one of the scientifically best prepared travellers who ever lived, and regarding the physical geography of Asia, unrivalled. Richthofen shows, however, how Humboldt's artificial and geometrical construction of the boundaries of Central Asia was not at all in harmony with the geological and interior structure of the continent, and, therefore, soon had to disappear, and he accepts the name Central Asia, which
had been abused in so many ways, only under condition that the central regions should be regarded in comparison with the peripheral ones'. He starts from the fact that the rivers are much better known than the mountains, and, therefore, he uses the hydrography for determining the boundaries of his different Asiatic regions. He separates the regions without outlet from those from which the water flows to the Ocean. Thus Richthofen obtains the following three great regions or physico-geographical provinces:

1. Central Asia, which is bounded by the Tibetan Plateau to the south, the Altai to the north, the water-parting of the Pamirs in the west, the water-parting of the Chinese Rivers, and the Khingan Mountains to the east.

2. Peripheral regions are all those, from which the rivers flow to the Ocean or to the Caspian and to Lake Aral.

3. The Intermediate Zone, situated between the first two and where regions which formerly had an outlet have been changed into Ocean-drained and once seafared.

In Richthofen's opinion the changes of climate are the chief factor in the formation of self-contained basins, and if such a basin again gets an outlet, it is also a new change of climate that is the cause. The precipitation does not need a considerable augmentation for providing a basin with an outlet.

Richthofen even believes that the Koko-nor (Tung-hai) is in a stage of rising and that its basin is approaching its flowing over. Between the feeders of the Yangtze there are certain self-contained basins which indicate that the whole country around not long ago was a salt steppie, in which the erosion has made its conquest along certain lines. He believes that the Tengi-nor belongs to the same category as the Koko-nor, so that it becomes more and more filled and is losing in salinity.

1. The latest abuse of the term Central Asia is to be found in the title of the scientific work on the great American Asiatic Expedition 1822-1830 under Leadership of Dr. Roy Chapman Andrews, viz. "The New Conquest of Central Asia", for only the eastern half of Central Asia was explored by these important and brilliant expeditions.
The most remarkable form of intermediate (Übergangs—) regions between central and peripheral areas, Richthofen finds in Tibet. But he complains of the scanty knowledge of the country at his time. A great portion of Eastern Tibet which sends its rivers to the sea, are, according to Richthofen, well-developed fossi-regions. He compares the Brahmaputra basin with the Upper Hwangho, when one self-contained basin after another has been captured by the drainage and transformed into peripheral country with outlet. He thinks that this change has taken place simultaneously with the last epoch of upheaval of the Himalaya and that the high ranges of Tibet took part in the same upheaval which also caused the glaciers to grow bigger and the rivers to become more abundant in water.

Richthofen regards the K'un-lun as the backbone of Eastern Asia. It stretches eastwards and its prolongation divides China Proper into two halves very unlike each other. In the heart of Asia it also plays the part of a great dividing wall. Already at the end of the Silurian age it rose as a considerable system. Richthofen found in its eastern portions that it never since the Silurian age had been covered by water, even if it had undergone several other changes. For a considerable length in China, it is the water-parting between the Hwangho and Yangtsze. As to the Tibetan portion of the K'un-lun, Richthofen's knowledge was, of course, insufficient; he did not and could not know Postbeksky's discoveries, and great parts of his Central K'un-lun were merely hypothetical, and his theories have, in many details, since then proved to be wrong. Considerable length, old age and homogeneity are the principal characteristics of the system. Geologically it is independent, and the foldings of later epochs have not influenced it. In China, south of the K'un-lun, the SW to NE stretching folds never cross it or form knots with it, but avoid it, as it were, turning ENE and east, leaving it alone. On the northern side the NE stretching folds turn to the west. All folds in its neighbourhood have been formed after the upheaval of the K'un-lun. Richthofen regards this system as one of the oldest features in the building up of the earth's crust. In the east it is the mere ruin of an originally much higher mountain. The peaks have disappeared, only the great bulk or mass of the system is left. The peaks may have been much higher than those of the much younger Himalaya.
Regarding the ranges north of the Tsangpo or Upper Brahmaputra, Richthofen was, in 1896, of the opinion that two ranges were situated there, the principal of them being a continuation of the Nii-then-tsoig-la and that the prolongation of this range to the NE was pierced by the Nakchu River. However, he could not be expected to have contributed in any more essential way to the problem of the Transhimalayas than Rerclus, for both used the same extremely poor material of their time, although Richthofen digested it more thoroughly than anybody else.

It would take us too far would we try to enter upon all the great problems dealt with by Richthofen. I will only remind you of the esteem and confidence he showed to Chinese cartography. Speaking of the maps of the Jesuits, he says: "They had become more and more acquainted with the very rich material of maps of the country; they could not help seeing that this material, so far as rivers and places are concerned is so far satisfied the demands of consciousness and reliability, that only that which really existed was represented...." (China, I, p. 681). In his classical article on Lop-nor, in which he criticized Poste-vally's views, (Verhandlungen der Gesellschaft für Erdkunde Berlin, Vol. V., 1878 p. 121 at seq.) he pointed out the fact, that the Chinese topographers never enter any geographical feature upon their maps unless they have themselves actually seen it. Nobody could be more keenly interested in the discovery of Lep-fan and the mapping of the ancient course of the Tarim River than Richthofen, for the discoveries made in the Lop Desert (1900-1901) proved that the theories he had built up in his above quoted article were perfectly correct.

After his return to Europe Richthofen was entirely absorbed by the working out of his rich results. But then he gave his soul and his overwhelming store of knowledge to his duties as a teacher and became surrounded by scores of disciples. The audience halls where his lectures took place were crowded by students, and I remember from 1889 and 1892, when I had the privilege to be one of them, how difficult it was to secure a place at Richthofen's lectures. And how could it be otherwise, as we all admired and loved him and knew that he was the greatest representative and promoter of geography of his time, the greatest of the second half of the last century. In spite of his popularity as a
teacher Richthofen had no ambition of founding a school of his own, and still his disciples of whom became famous as geographers or explorers, every year have a meeting in Berlin to celebrate his memory and the great work of his life.

This year the "Richthofen-Tag", as this meeting is called, took place one hundred years after Richthofen's birth, and I am very happy to have got this opportunity by the courtesy of Dr. Wong Wen-hao, to say these few words to the memory of the immortal scholar who loved China and was the founder of our knowledge of Chinese geology.

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