

Introduction to the history of malacology in China

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Although the history of mollusk utilization is long in China, modern malacological studies started very recently compared with those in western countries. Because most early books, papers and reports on Mollusca in China were written in Chinese, these early research studies were unknown to foreign scholars. Nowadays, malacological studies are well developed and cover almost every field within this domain. The history of malacology in China is briefly summarized, with research conducted from 1920s–1980s emphasized.

Key words: China, malacology, history, taxonomy.

Введение в историю малакологии Китая

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Хотя использование моллюсков в Китае имеет длительную историю, современные малакологические исследования начались относительно недавно, в сравнении с таковыми в западных странах. Поскольку наиболее ранние книги, статьи и сообщения о моллюсках Китая были написаны на китайском языке, эти исследования были малоизвестны иностранным ученым. В настоящее время, малакологические исследования очень развиты во всех областях этой науки. В статье кратко описана история малакологии в Китае, в особенности исследования, проведенные в период 1920–1980-х гг.

Ключевые слова: Китай, малакология, история, систематика.

The utilization of molluscs by ancient Chinese peoples

The observations and utilization of molluscs in China began as far back as 50,000 years ago in the Stone Age. Before 1500 BC, shells of Cypraeidae, such as *Monetaria moneta* (Linnaeus, 1758), *Monetaria annulus* (Linnaeus, 1758), *Cypraea tigris* Linnaeus, 1758, *Erronea erronea* (Linnaeus, 1758), were used as money, with tens of thousands of these shells found in prehistoric graves. The earliest record of molluscs in a book can be traced to the oldest surviving Chinese dictionary, *Erya*, in the 3rd century BC [Liu, 2007]. In feudal China, shells were recorded in many ancient books based on their nutritional, medicinal and decorative values. The morphological features, habits and characteristics of mud snails, river clams, razor clams, giant clams,

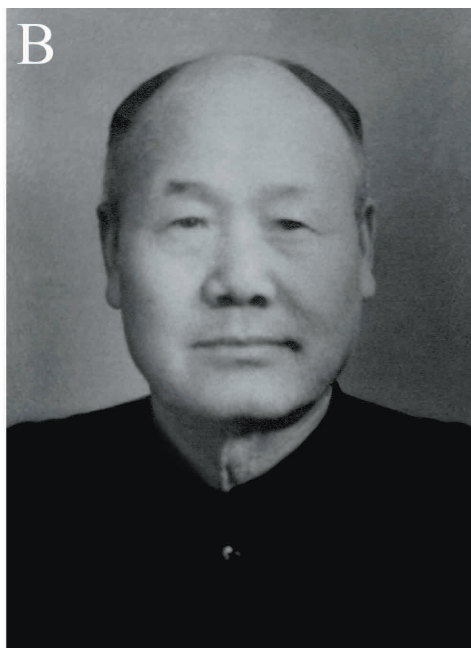
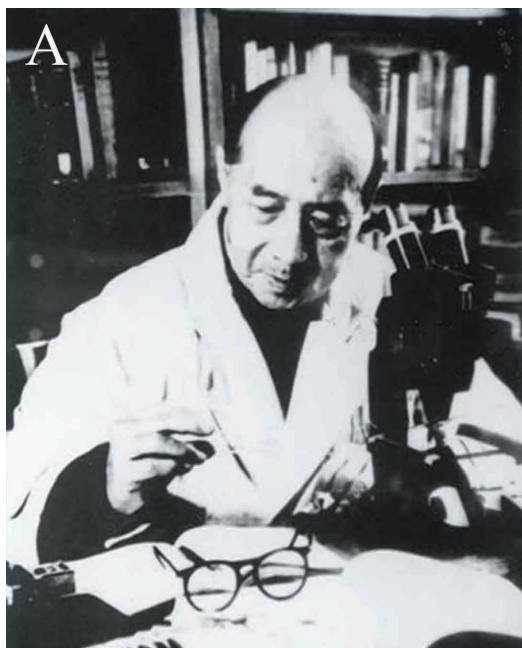
oysters and squids were correctly described. More than 30 molluscs were recorded as natural medicines in *Compendium of Materia Medica*, a traditional Chinese book on herbs by Li Shizhen during the Ming Dynasty [Xie, Lin, 1986]. It is noteworthy that Chinese people mastered the skills of artificial culturing of oysters for food [Qi, 2004] and river clams for pearls [Liu, 2007] as early as 2,000 years ago.

Early works by foreign scientists

Modern malacological studies in China started very late, and many early works were done by foreigners. During the 18th to 19th century, some foreign scholars, merchants and missionaries came to China. They collected many shells from China and took them home or sent them to institutions and museums for research. Chinese shells were then reported in scattered papers, monographs and reports by foreign malacologists [Yen, 1941a; Tchang et al., 1963]. Some research vessels also came to Chinese seas to conduct surveys, such as the voyage of the H.M.S. *Samarang*, the voyage of the H.M.S. *Challenger*, the Dutch *Siboga* expedition and expeditions of some American vessels [Xu, Zhang, 2011; Yen, 1944]. Many specimens, including type materials collected from China, are deposited in museums of the U.S.A., Great Britain, France and Germany. For example, nearly a thousand species of Gastropoda are deposited in the Natural History Museum in London [Qi, 1979].

The start of Chinese modern malacology

Until the 1920s, the Science Society of China, Institute of Zoology, National Academy of Peiping, and the Fan Memorial Institute of Biology were established. Chinese researchers, Ping Chi (1886.4.9–1965.2.21), Sohtsu Gee King (also spelled as “Sho-Tsu G. King”, or “Chin Shao-Chi”) (1886–1949), Teng-Chien Yen (also “John Teng-Chien Yen”) (1903.2.15–1972.2.4) [Anonymous, 1972], and Tchang Si (1897.1.10–1967.7.10), conducted systematic investigations of molluscs (see Figure). A German-American scientist Amadeus William Grabau (1870.1.9–1946.3.20) and a Chinese malacologist Sohtsu G. King made the first scientific study of shells of Peitaiho, now known as Beidaihe, Heibei Province [Grabau, King, 1927–1928, 1928] (E.V. Coan et al., in preparation). Sohtsu G. King and Ping Chi reported molluscan shells from Hong Kong [King, Ping, 1931–1936], and found a new species of scaphopods from Peitaiho [King, Ping, 1935]. Ping Chi, zoologist, educationist, and one of the great founders of Chinese modern biology, also studied the gastropods of the Chinese coast [Ping, Yen, 1932a]; the freshwater and terrestrial snails from Peiping (Beijing), Hopei (Hebei), Kirin (Jilin) [Ping, Yen, 1932b], Sin-King (Xinjiang), Kansu (Gansu) [Ping, 1932; Ping, Yen, 1933], and Anhui [Ping, 1938] provinces; and the fossil



A, Ping Chi (秉志); **B**, Tchang Si (张玺); **C**, Qi Zhongyan (Tsi Chung-Yen) (齐钟彦) (left) and Ma Xiutong (Ma Siu-Tung) (马绣同) (right).

mollusks of Mongolia [Ping, 1930, 1931]. The Chinese-American researcher Teng-Chien Yen studied the marine gastropods from Amoy (Xiamen) [Yen, 1933], the South China Sea [Yen, 1935a, 1936a] and Shantung (Shandong) Peninsula [Yen, 1936b]; land and freshwater mollusks [Yen, 1941b, c, 1943a, 1948]; and Tertiary and Quaternary mollusks [Yen, 1935b, 1936c, 1943b]. He also reported on the Chinese gastropods in the Senckenberg Museum, Germany [Yen, 1939], the British Museum (Natural History) [Yen, 1942], and some unfigured types in the U.S.A. [Yen, 1944]; more Yen's publications see: Zapfe [1973].

After obtaining a Ph.D. in France in 1931, Tchang Si, who is considered as the founder of Chinese malacology, returned to China and continued his study on opisthobranchs [Tchang, 1934a,b], oysters [Tchang, Xiangli, 1937] and prosobranchs [Tchang et al., 1940]. Tchang Si was also in charge of the first systematic investigation of marine organisms in Jiaozhou Bay in China during 1935–1936. Most reports of this investigation involved mollusks [Tchang, 1935; Tchang, Xiangli, 1936; Tchang, Ma, 1936, 1949]. The research results laid the foundation not only for malacology, but also for marine biology and ecology in China.

When the Institute of Zoology moved from Peking (Beijing) to Kunming after the breakout of the Anti-Japanese War, Tchang Si held the post of Director. During this time, Qi Zhongyan (Tsi Chung-Yen) (1920.3.12–2013.11.16), who later became another important malacologist, began to study mollusks. Tchang Si and his colleagues conducted comprehensive investigation of Kunming Lake and studied the snail *Margarya* Nevill, 1877 [Tchang, Cheng, 1945; Tchang, Tsi, 1949; Tchang, Hsia, 1949].

Rapid growth of Chinese malacology

After the founding of the People's Republic of China, scientific research institutes were reorganized. On August 1, 1950, the Department of Marine Biology, Institute of Hydrobiology, Chinese Academy of Sciences, was established in Qingdao, which is the predecessor of the Institute of Oceanology, Chinese Academy of Sciences. Tchang Si unhesitatingly gave up his job in Beijing and moved to Qingdao with some of his books, papers and shell collections to work as a Deputy Director. Among the other malacologists, who came to Qingdao, were Qi Zhongyan, Li Jiemin (Li Kie-Min), and Ma Xiutong (Ma Siu-Tung) (1912–1999) (Fig.). Later, the malacologists formed a molluscan research group, which studied the taxonomy, biogeography, morphology, and ecology of marine molluscs.

As the head of the Chinese side of the Sino-Soviet joint marine organism investigative team, Tchang Si led investigations of the intertidal zone along the coasts of Qingdao, Tanggu, Dalian, Zhoushan, Zhanjiang and Hainan Island from 1957 to 1960. Of these localities, the investigation of Hainan Island was the most compre-

hensive, with two visits each year. Based on the development on taxonomy, Tchang Si and Qi Zhongyan led their students to conduct experimental ecology and aquaculture works on oysters, abalones, mussels, scallops, pearl oysters, and other economic molluscs, and to study destructive shipworms and piddocks. Under the leadership of Tchang Si and Qi Zhongyan, Chinese marine biologists carried out comprehensive investigations of all Chinese seas along the coast of the country from the intertidal zone to shallow waters, and from the Yalujiang Estuary to Guangxi Province, and Hainan Island, especially the *National Comprehensive Oceanographic Survey* of Chinese coast and shallow waters from 1958 to 1960 and *China-Vietnam Joint Expedition on Marine Resources* to Beibu Bay (Gulf of Tonkin) from 1959 to 1962. The data and specimens obtained from these investigations fueled the development of the biology and ecology study on marine organisms.

In the early 1950s, the Institute of Zoology of the Chinese Academy of Sciences was established in Beijing. The molluscan research of the institute mainly concentrated on the taxonomy and fauna of freshwater and terrestrial molluscs, destructive molluscs and medical malacology. Tchang Si became a researcher there and studied *Oncomelania hupensis* Gredler, 1881, which is the only intermediate host of an important parasite, *Schistosoma japonicum* (Katsurada, 1904), and bivalves in Dongting Lake [Tchang et al., 1965] and Poyang Lake [Tchang, Li, 1965]. Tchang Si also took charge of the molluscan research in the South China Sea Institute of Oceanology, Chinese Academy of Sciences, which was founded in Guangzhou in 1959. He initiated the cultivation of the pearl oyster *Pinctada* Röding, 1798, and obtained an abundant harvest of pearls by artificially inserting a nucleus. During that time, various institutes and colleges of fisheries, aquatic biology and oceanography were established and trained people in studying and cultivating molluscs, as well as in teaching malacology. Since then, malacology in China entered an unprecedented era of development.

Published in 1961 by Tchang Si and Qi Zhongyan, *Outline of Malacology* laid foundations of Chinese modern malacology and is considered a significant milestone. Other important books published during this time included *Economic Marine Mollusca in North China Sea* [Tchang et al., 1955 in Appendix II], *Bivalvia Mollusca of South China Sea* [Tchang et al., 1960 in Appendix II], *Economic Fauna of China: Marine Mollusca* [Tchang, Qi, 1962 in Appendix II], *Animal Atlas of China: Mollusca*, Volume I [Tchang et al., 1964 in Appendix II]. During this period, scientific studies focused on the families Mytilidae, Pteriidae, Pinnidae, Ostreidae, Cardiidae, Tridacnidae, Veneridae, Solenidae, Pholadidae, Teredinidae, Haliotidae, Strombidae, Cypraeidae, Muricidae, Aplysiidae, Pleurobranchidae, Lolinidae, Sepiidae, Octopodidae.

Based on the materials previously collected on molluscs and analysis of their distribution, the seas of China were divided into three regions: the Yellow Sea and Bohai Sea were classified into a warm temperate Far East subregion of the North Pacific Region; the East China Sea, the northwestern coast of Taiwan and the northern

Summary of congresses of the Chinese Society of Malacology and Transactions published

Congress	Date	Place	Theme	Number of papers received	Number of participants	Transactions
1 st	11–15 Sept., 1981	Guangzhou, Guangdong Province		138	88	N 1
2 nd	1–5 Nov., 1983	Chengdu, Sichuan Province		123	108	N 2
3 rd	3–9 Nov., 1986	Kunming, Yunnan Province		168	105	N 3
4 th	4–9 Nov., 1988	Huangshan, Anhui Province		114	100	N 4
5 th	21–25 Oct., 1991	Qingdao, Shandong Province		80	128	N 5
6 th	24–30 Oct., 1993	Xi'an, Shaanxi Province		57	110	N 6
7 th	21–27 Oct., 1995	Ningbo, Zhejiang Province		90	80	N 7
8 th	4–10 Oct., 1997	Nanji Island, Zhejiang Province		108	129	N 8
9 th	26–29 Oct., 1999	Tai'an, Shandong Province		85	110	N 9
10 th	12–16 Nov., 2001	Wuxi, Jiangsu Province	Mollusca and Human Health	76	101	N 10
11 th	17–22 Oct., 2003	Dalian, Liaoning Province	Molluscan Research and Protection of Environment and Resources	127	140	N 11
12 th	21–24 Sept., 2005	Taiyuan, Shanxi Province	Molluscan Resources and Sustain- able Utilization	103	96	N 12
13 th	16–19 Oct., 2007	Ji'nan Shandong Province	Molluscan Biodiversity and Sustain- able Utilization of Resources	111	128	N 13
14 th	7–12 Nov., 2009	Nanchang, Jiangxi Province	Sustainable Utilization of Molluscan Resources	183	~200	N 14
15 th	28 Nov.–1 Oct., 2011	Guangzhou, Guangdong Province	Thirty years of Chinese Malacology	241	~300	N 15
16 th	10–16 Oct., 2013	Chengdu, Sichuan Province	Mollusca and Global Change	168	260	N 16

Note . Data are taken mainly from <http://www.czs.ioz.ac.cn> and Zhang et al. [2011].

coast of Hainan were recognized as a subtropical Sino-Japanese subregion of the Indo-West-Pacific Region; and a tropical Indo-Malayan subregion included the southeastern coast of Taiwan, the southern coast of Hainan Island and the area south of them. Three components were identified in the Chinese marine molluscan fauna: a boreal element occurring only in the Yellow and Bohai seas, an Indo-West-Pacific element widely distributed along the coasts or restricted to the East and South China seas or only to South China Sea, and a China-Japan endemic element including some temperate species in the Yellow Sea and warm-water species in the East and South China seas [Tchang, 1959; Tchang, Qi, 1959; Tchang et al., 1963].

Modern status of Chinese malacology

In order to establish an exchange channel for malacologists from home and abroad, promoting the development of research in various areas of malacology, the Chinese Society of Malacology was established in 1981 by Prof. Qi Zhongyan, who was also its first Director General. It is a branch of the China Zoological Society and the Chinese Society of Oceanography and Limnology, affiliated to the Institute of Oceanology, Chinese Academy of Sciences. The first volume of *Transactions of the Chinese Society of Malacology* was published in 1983. Since then, the society has held academic conferences (congresses) every other year. Until 2013, 16 congresses of the Chinese Society of Malacology were held with 15 volumes of the Transactions published [see Table and Appendix III].

Through several decades of development, malacology in China has covered marine, freshwater, terrestrial, medical and fossil mollusks, involving the areas of taxonomy, faunistics, morphology, ecology, physiology, biochemistry, genetics and aquaculture [Ma, Xie, 1991; Zhang et al., 2011]. Dozens of books on the taxonomy of Mollusca were published including 12 volumes of *Fauna Sinica* [Appendix II]. *Sea Shells of China*, published in 2004 and edited by Qi Zhongyan, is the first and most systematic English-translated edition, showing 1661 species in colour photographs, including about 50 holotypes. It resulted from the long-standing work of about 60 years by malacologists of the IOCAS in their collecting, examining, and identifying the vast amount of specimens. Recently published *An Illustrated Bivalvia Mollusca Fauna of China Seas* [Xu, Zhang, 2008] and *Atlas of Marine Mollusks in China* [Zhang, 2008] have become essential manuals for molluscan identification. By now, a total of 3914 species belonging to 290 families have been recorded in China, including more than 240 species new to science. Among them, 2566 species of 160 families are Gastropoda; 1132 species of 78 families belong to Bivalvia; Cephalopoda includes 30 families and 125 species; Polyplacophora encompasses 9 families and 47 species; and each class of Chaetodermomorpha and Neomeniomorpha has only one species [Liu, 2008].

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Appendix I

Some important taxonomists on Mollusca in China

Chaetodermomorpha and Neomeorpha: Xu Fengshan (徐凤山)

Scaphopoda: Sohtsu Gee King (金叔初); Tchang Si (张玺); Qi Zhongyan (齐钟彦)

Polyplacophora: Xu Fengshan (徐凤山)

Gastropoda: Sohtsu Gee King (金叔初); Ping Chi (秉志); Teng-Chien Yen (阎敦建); Tchang Si (张玺); Qi Zhongyan (齐钟彦); Ma Xiutong (马绣同); Dong Zhengzhi (董正之); Lin Guangyu (林光宇); Lu Duanhua (吕端华); Zhang Fusui (张福绥); Li Fenglan (李凤兰); Zhang Suping (张素萍); Chen Deniu (陈德牛)

Bivalvia: Sohtsu Gee King (金叔初); Tchang Si (张玺); Qi Zhongyan (齐钟彦); Li Jiemin (李洁民); Lou Zikang (楼子康); Wang Zhenrui (王祯瑞); Zhuang Qiqian (庄启谦); Xu Fengshan (徐凤山); Huang Xiuming (黄修明); Li Fenglan (李凤兰); Liu Yueying (刘月英)

Cephalopoda: Tchang Si (张玺); Qi Zhongyan (齐钟彦); Dong Zhengzhi (董正之)

Appendix II

Some important taxonomic books on Mollusca in China (in chronological order)

Grabau A.W., King S.G. 1928. Shells of Peitaiho. Second Edition. Peking: Peking Laboratory of Natural History. 279 p. [In English]

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- Tchang Si, Qi Zhongyan, Li Jiemin, Ma Xiutong, Wang Zhenrui, Huang Xiuming, Zhuang Qiqian.* 1960. Bivalvia Mollusca of South China Sea. Beijing: Science Press. 274 p. [In Chinese] [张玺, 齐钟彦, 李洁民, 马绣同, 王祯瑞, 黄修明, 庄启谦. 1960. 南海的双壳类软体动物. 北京: 科学出版社. 274 p.]
- Tchang Si, Qi Zhongyan.* 1961. Outline of Malacology. Beijing: Science Press. 387 p. [In Chinese] [张玺, 齐钟彦. 1961. 贝类学纲要. 北京: 科学出版社. 387 p.]
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- Tchang Si, Qi Zhongyan, Ma Xiutong, Lou Zikang, Liu Yueying, Huang Xiuming, Xu Fengshan.* 1964. Animal Atlas of China: Mollusca. Volume I. Beijing: Science Press. 84 p. [In Chinese] [张玺, 齐钟彦, 马绣同, 楼子康, 刘月英, 黄修明, 徐凤山. 1964. 中国动物图谱 软体动物 第一册. 北京: 科学出版社. 84 p.]
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- Qi Zhongyan, Ma Xiutong, Lou Zikang, Zhang Fusui.* 1983. Animal Atlas of China: Mollusca. Volume II. Beijing: Science Press. 150 p. [In Chinese] [齐钟彦, 马绣同, 楼子康, 张福绥. 1983. 中国动物图谱 软体动物 第二册. 北京: 科学出版社. 150 p.]
- Qi Zhongyan, Ma Xiutong, Wang Yaoxian, Liu Yueying, Liu Wenzhen, Chen Deniu, Gao Jiaxiang.* 1985. Animal Atlas of China: Mollusca. Volume IV. Beijing: Science Press. 150 p. [In Chinese] [齐钟彦, 马绣同, 王耀先, 刘月英, 刘文珍, 陈德牛, 高家祥. 1985. 中国动物图谱 软体动物 第四册. 北京: 科学出版社. 150 p.]
- Qi Zhongyan, Lin Guangyu, Zhang Fusui, Ma Xiutong.* 1986. Animal Atlas of China: Mollusca. Volume III. Beijing: Science Press. 115 p. [In Chinese] [齐钟彦, 林光宇, 张福绥, 马绣同. 1986. 中国动物图谱 软体动物 第三册. 北京: 科学出版社. 115 p.]
- Wang Rucai* (Ed). 1988. Coloured Illustrations of Aquatic Molluscs in China. Hangzhou: Zhejiang Publishing House of Science and Technology. 255 p. [In Chinese] [王如才 主编. 1988. 中国水生贝类原色图鉴. 杭州: 浙江科学技术出版社. 255 p.]
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- Dong Zhengzhi.* 1988. Fauna Sinica, Mollusca, Cephalopoda. Beijing: Science Press. 201 p. [In Chinese] [董正之. 1988. 中国动物志 软体动物门 头足纲. 北京: 科学出版社. 201 p.]
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- Chen Deniu, Zhang Guoqing.* 1999. Fauna Sinica, Mollusca, Gastropoda, Pulmonata, Stylommatophora, Clausiliidae. Beijing: Science Press. 210 p. [In Chinese] [陈德牛, 张国庆. 1999. 中国动物志 软体动物门 腹足纲 柄眼目 烟管螺科. 北京: 科学出版社. 210 p.]
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- Chen Deniu, Zhang Guoqing.* 2004. Fauna Sinica, Mollusca, Gastropoda, Stylommatophora, Bradybaenidae. Beijing: Science Press. 482 p. [In Chinese] [陈德牛, 张国庆. 2004. 中国动物志 软体动物门 腹足纲 巴蜗牛科. 北京: 科学出版社. 482 p.]
- Xu Fengshan.* 2012. Fauna Sinica, Mollusca, Bivalvia, Lucinacea, Carditacea, Crassatellacea, Cardiacea. Beijing: Science Press. 239 p. [In Chinese] [徐凤山. 2012. 中国动物志 软体动物门 双壳纲 满月蛤总科 心蛤总科 厚壳蛤总科 鸟蛤总科. 北京: 科学出版社. 239 p.]

Appendix III

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- Transactions of the Chinese Society of Malacology. N 15. Published in: *Marine Sciences*, V. 37, N 8. 2013. Beijing: Science Press. 136 p.