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Some Personal Observations on the Status of Marine Sciences in the People's Republic of China

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Owing to the long hiatus in communication with the People's Republic of China (PRC) during the Cultural Revolution and the inability of most westerners to read the original Chinese literature, a great deal of marine science research in PRC is not known to the outside world. I have felt that progress in marine science in general could be accelerated with better awareness of the existence of a large Chinese data base. Also, duplication of efforts caused by lags in communication could be averted if a review of the status of marine science research in PRC were available.

At the invitation of Shandong College of Oceanography in April 1983, I visited eight oceanographic institutions in PRC for a month with the primary goal of ensuring a thorough and efficient acquisition of marine chemistry publications, particularly items published in the "gray literature." A report "Marine Chemistry in the People's Republic of China" with extensive bibliography has been prepared for the Office of Naval Research (ONR) (C.-T. A. Chen, Marine Chemistry in the People's Republic of China, *Doc. 454 158 19338*, U. S. Government Printing Office, Washington, D. C., 1984), and a limited number of copies are available from the author. In the following report, I give only my impressions of oceanographic research in PRC obtained from my site visit and from my conversations with visiting PRC marine chemists in America. I must point out at once, however, that exceptions to my description, given below, certainly exist.

Marine Scientific and Technological Information

Scientific and technological information is flowing relatively freely in PRC, albeit at a slow pace and with certain restrictions. I will discuss the availability of scientific information in three categories.

Exchange of Information Within PRC

Every major research or teaching institute seems to publish at least one technical journal that is widely distributed in PRC. All institutes have their own libraries, and the current publications are displayed. Researchers can check out only a limited amount of material. Copying machines are all but unavailable and expensive to use; there are also few microfilm readers, and no national computer data base. IBM 1620–type computers are used in several of the oceanographic centers. Most tasks are still performed manually. For instance, monthly hand-written tidal tables from 51 ocean stations are tabulated and plotted by hand at the Institute of Marine Scientific and Technological Information. A Chinese-made computer is available there (which uses paper tape), but a modern minicomputer is being imported. Understandably, printed hard copy is normally used to transmit numerical data. Nationwide technical meetings, where researchers exchange information freely, are held frequently.

Information Flow Into PRC

Major foreign oceanographic journals are available in all oceanographic institutions. Most of the journals are reproduced in Beijing and later distributed, with a delay of 8 to 18 months. Reports published by foreign institutions are available through exchange. There is a large number of Russian publications, but Japanese and English publications seem to be expanding at a faster rate. In order to improve the information flow, many foreign scientists visit and lecture at the PRC oceanographic institutions. Foreign visitors are generally treated exceedingly well.

Information Flow Out of PRC

This is the area that has received the most restrictions. The policy of PRC, apparently, is to classify all information unless specifically unclassified. For example, very few journals published in Chinese before 1980 can be taken out. There are signs, however, that information is beginning to flow out of PRC more freely. Several journals changed names in 1982. These "new" journals are not classified, whereas the "old" ones were. The China National Publishing Industry Trading Corporation, which is in charge of exporting PRC publications, accepts orders for some marine science publications.

A data center similar to the National Oceanographic Data Center (NODC) (see *Eos*, May 4, 1982, p. 275) is being established, with NODC's assistance, in the Institute of Marine Scientific and Technological Information, National Bureau of Oceanography (NBO), in Tianjin. The institute collects, processes, stores, and provides marine scientific and technological information and data from PRC and abroad. It also functions as an International Oceanographic Committee depository center and exchanges a limited amount of information with NODC. U.S. scientists attempting to gain access to Chinese data and results will have a better chance if they send their requests through official channels.

Instrumentation

The use of advanced instrumentation is now widespread. The Chinese manufacture various spectrophotometers, anodic stripping voltimeters, and mass spectrometers. Development of marine instruments and equipment is carried out at essentially all marine research and teaching institutions. These efforts seem to be focused on instruments such as *p*H meters. Chinese-made versions of large instruments such as autoanalyzers and spectrophotometers are available, but the higher-priced major instruments are mainly purchased from Japan and western countries. Procurement of foreign items receives much review. All approved requests are finally funneled through a central Instruments Import and Export Corporation. It takes 2–3 years to receive an item after a successful request. Passage of the patent law in 1984 may open the way for licensing or joint production with foreign manufacturers of state-of-the-art equipment.

Ship Operations

PRC has an oceanographic research and survey fleet of 150 vessels totaling over 100,000 tons. Some are quite large, with several exceeding 3000 tons. Until recently, the ships have been operating in coastal and continental shelf regions, as even the large ships sometimes do not yet have deep-water sampling capability. On-board instrumentation is scarce, but laboratory space is ample. Shandong College of Oceanography's 2740-ton *East is Red* even has a lecture hall which seats at least 50. Some recent geophysical survey vessels are equipped with state-of-the-art instrumentation, perhaps reflecting PRC's strong emphasis on offshore exploration for petroleum. The three subbureaus of the NBO operate the NBO ships, whereas the Academia Sinica and the Ministry of Education ships are run by the institutions that own them.

Surveys

China maintains long records of coastal salinity data, some dating back more than 100 years. Continuous water chemistry data for the Huanghe ("Yellow River"), in Jiaozhou Wan (Bay), and in the Changjiang ("Yangtze") estuary date back several decades. Most of the ocean surveys have been performed in the PRC territorial waters. PRC, however, has started to make routine surveys in the Taiwan Strait, which until recently was totally controlled by the Republic of China on Taiwan.

Deep ocean surveys began only recently. Early blue water measurements were all part of international multiship programs. The first single-ship expedition was carried out by the PRC-built 4000-ton R/V *Xiangyanghong 16* in the Western Pacific (7–13°N, 167–178°W) between May 7 and July 10, 1983. Manganese modules were recovered from depths of 5000 m.

Research on and around Antarctica has recently begun. Initial efforts were in collaboration with Australian and New Zealand scientists and concentrated on marine biological studies and living resources. PRC achieved a form of observer status under the 1959 Antarctic Treaty in June 1983, and it plans to send a 14,000-T research vessel (R/V *Xiangyanghong 10*) on a circum-Antarctic expedition between December 1984 and March 1985.

Funding for Research

Most research is supported by block operational funding to the institutions, which in turn provide "hard" salary and research funding internally to the staff. Research money competes internally with all other expenses, such as salaries, building and maintenance, ship operation, etc. A selected few obtain research funding from the Academia Sinica Science Fund. More money per grant is available from this source, but competition is strong. A small amount of money is provided to a faculty member for research if he has graduate students under his guidance. All research topics must be approved by the Office of Scientific Research at each institution.

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Serving the needs of the people carries a lot of weight in regard to whether a research topic is approved.

Students

Formal college entrance examinations resumed in 1977, after the Cultural Revolution. The first group of students entered in early 1978 and graduated in early 1982. Students (20% female) are highly motivated: they must be younger than 30 years old, are not allowed to marry while in school, and must live in dormitories. They receive free room and board plus stipends.

Both teaching and research institutions admit graduate students, but only Shandong College of Oceanography, the Department of Oceanography of Xiamen University, the Institute of Estuarine and Coastal Research (East China Normal University), and the Institute of Oceanology currently have oceanography graduate students. The three institutes of NBO may soon admit graduate students too.

Study in Foreign Countries

Most of the marine scientists at the professorial level in PRC received advanced education from western countries before 1950. Since the end of the Cultural Revolution, researchers are again allowed to study abroad (mostly on PRC fellowships).

Initially, only faculty members went abroad, because the first class of college students for over a decade did not graduate until 1982. Generally speaking, faculty members or research scientists who go abroad are expected to learn a selected research topic and transfer the knowledge back quickly in order to fill an existing gap. On the other hand, the cream of recent college graduates are sent abroad (on 1-year PRC fellowships) to receive a more balanced training and to earn an advanced degree.

Competition for fellowships is fierce (about 10% of the faculty have been sent abroad). After passing tests and other considerations, those who would stay abroad for a year or longer, faculty and students alike, are sent to foreign language institutes for 6 months of intensive language training.

International Collaborative Field Program

The scientists and administrators to whom I talked all agreed that international collaborative programs are beneficial to all parties concerned. They appreciate that joint field programs would greatly accelerate their transition from a laboratory-confined marine sciences program to a balanced laboratory and field oceanographic program. It is clear that possibilities of substantive collaborative research do exist, but lengthy discussion must be expected. Agreement to transfer advanced technology, especially instrumentation, during and after the completion of a collaborative program would be most welcome. As a possible aid to such exchanges, it should be noted that the United Nations Development Program has had an office in Beijing since 1979 and is offering assistance to international collaborative programs.

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