特集II・発展途上国における開発と環境問題

Development and its environmental impact in the Western Pacific

西太平洋地域における開発とその環境に及ぼす影響

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本文の概要と筆者の紹介

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本文の概要

(1) 概説

西太平洋地域内のほとんどすべての国が、国民の生活水準を向上させるために開発計画を優先させ、工業化や人造肥料・農薬の過用を伴う農業の高度化、石油、ガス、鉱石等の採掘、都市建設や高速道路網の促進を行った。その最初の段階では、こうした開発が環境に及ぼす影響に対し、注意が払われなかったため、河川・湖沼の水質汚濁や都市部・工場地帯での大気汚染が、人々の健康と厚生とおびやかす、所期の目的と相反するような結果が生じはじめた。こうした事態が発生し、顕在化しはじめても、積極的な対策はただちに採られなかった。その理由は、(a)環境保護のための経費がかかり過ぎて、工場の新設やその他の開発行為に支障を及ぼす；(b)もし強制的に環境保護のための対策を実施すると、製品や商品の価格が高騰し、国際競争が失われる、2点であった。

しかし、大衆の要望と「ただ一つの地球」といった環境保護の必要性とが、世界中の多くの科学者、政治家等によって支持され、西太平洋地域でも、ほとんどの国が環境保護、汚濁防止のための法律を制定し、また関連行政を補間するために、独立した集約的な「環境機関」が、各国政府に設けられるようになった。さらに、環境影響評価(EIA)の手法が、2, 3の国では展開・補強され、各種の開発計画にあたってこうしたEIAを考慮に入れるという傾向が生じた。これによって各国の環境は改善されて行くであろうが、直

面している問題はしばらく残置されるであろう。

環境影響が話題となるときは、非難の鋒先は常に工業へと向けられる。健康有害物質や生活環境をそこなう物質の多くが工場排水に含まれていることは否定できないが、西太平洋地域では農業関連事業および人口都市集中化によって環境問題が生じていることが多い。とくに後者について、この地域では下水道施設や廃水・廃棄物の処理施設を備えているところは僅少である。次に、2例を挙げてこうした事情を説明しよう。

(2) マレーシア国における天然ゴム・ヤシ油生産に伴う水質汚濁

同国内に広く分布している標記の関連企業は、同国での最大の生産額をはこるが、同時に水質汚濁の最大の源となっている。こうした工場は河川の上流域に立地し、農場経営や原料処理の際に莫大な汚濁負荷を発生している。同国の環境廳(DOE)の発表によると、1979年度に全国から寄せられた水質関連の苦情のうち、54%がゴム・ヤシ工場排水、20%が他種の工場排水、10%が鉱山・選鉱排水、8%が養豚排水、6%が都市下水に原因するもので、こうした比率が水質汚濁の実情を適格に反映していることは、概して認められたのである。

(3) フィリピン共和国のラグナ湖の水質管理

この湖はマニラの東南約15kmにあり、当地域では最大の淡水湖で、その水面積は 9×10^4 ha、流域面積は382km²、平均水深は2.8mである。この湖はマニラ主都圏の水道の主水源となる予定であるが、現在では主として養魚、かんがい、舟運の便に供せられている。主な水質問題は、 5×10^5 個/mlにも及ぶソウ類による富栄養化現象で、これは流入水中のリンと窒素とを

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規制することによって防止できるが、流入支川中には高含リン岩層を流過するものがあるので、リンの制御は実際的ではない。そこで流入水中の窒素を規制するために、1975—78年に同国政府とWHOとが資金を出し、国連開発計画（UNDP）とアジア開発銀行（ADB）とが資金援助をして、共同研究を行った。その結果、1975—76年の1年間で、各種の発生源からこの湖へ流入する窒素の負荷量は、合計で3,942t/yrであり、その内訳は、農業関連が48%〔そのうち、養豚16%、家禽類7%、他の動物5%、田畑20%〕、家庭下水が36%、工場排水が5%、その他が11%であり、このように農業関係の寄与率が最大であった。しかし養魚事業とマニラ主都圏上水道源としての将来の上水道拡張計画とからみれば、工場排水に含まれる毒性物質には、最大の関心が払われなければならないことを指摘しておく。

(4) 付記

本文（英文）の筆者は、上述の見解はWHOの公式見解を表明するものではないことを断わっている。

筆者の紹介

筆者の Dr. Yao は、世界保健機構（WHO）、西太平洋地域事務局（WPRO）、環境計画促進・応用研究センター（PEPAS）の水質管理官、所長代理であり、紹介者（岩井）が1982年の9/10月に同所でWHO顧問としてセミナーに参加出講した際に、非常に御世話になったことから、今回の御寄稿を頂くことになった。Dr. Yao は、砂ろ過理論における軌道理論（trajectory theory）の捕集効率（single collector efficiency）を、拡散、さえぎり、重力沈降の三つの原因に分けて解析したことで著名な学者であり（Env. Sci. Tech., Vol. 5, 1971, P. 1105）、日本について深い理解を持たれていることを付記しておく。

AN OVERVIEW

Development has been given top priority in almost all the countries in the Western Pacific in an effort to improve people's living standards. Development takes many forms. The main areas include industrialization, intensive agricultural activities involving heavy application of manufactured fertilizers and pesticides, accelerated exploitation of natural resources such as oil, gas and mining, urbanization and the related construction of infrastructures such as highway networks.

In the initial stage, very little concern was given to the environmental effects of such developments. As a result, water pollution of rivers and lakes and air pollution of urban centres and industrial towns began to threaten the health and wellbeing of the people for whose welfare the developments were supposed to be undertaken.

Even with the realization and manifestation of the possible adverse environmental impact of many of the development activities, prompt effective positive measures were still not immediately taken in a number of the countries. The main argument was that expenses for environmental protection would be too heavy a burden on the newly established industrial base and other developments which were considered to be essential for the

progress of the country. Another argument was that, if proper measures to minimize adverse environmental consequences were mandatory for economic developments, products or commodities could become so high-priced that they might lose competitiveness on the world market.

However, popular demand for better environment and an impressive campaign to save the planet EARTH supported by well-known personalities in science and politics coupled with the deterioration of the environment in some parts of the world, politicians, administrators, elected representatives and other concerned persons started to take necessary steps for environmental protection.

Most countries in the Western Pacific have now adopted comprehensive legislation on either environmental protection or pollution control. Consolidated and integrated environmental agencies were established to implement the related activities. Several countries are either developing an environment impact assessment (EIA) procedure or implementing it. One main objective is to require development planners to take environmental impact into consideration in the planning process.

With this new trend in environmental protection, the environment in the Western Pacific countries should get better in the years to come. However, many existing environment problems will probably stay for some time before getting better.

In many cases, whenever the topic environmental impact is mentioned, the accusing finger tends to go for industries. There is no doubt that industries produce discharges containing many undesirable and sometimes toxic contaminants. However, in the Western Pacific region, many serious environmental problems are associated with agriculture-related activities and wastes from urban populations since very few cities in many of the countries in the Western Pacific have well-developed sewerage systems or adequate human/domestic waste disposal systems. The following are two examples illustrating the environmental impact of development activities in the Western Pacific.

WATER POLLUTION DUE TO RUBBER AND PALM OIL PRODUCTION IN MALAYSIA

Malaysia is the largest producer of natural rubber and palm oil. The rubber and palm oil-related agroindustry represents one of the most significant causes of water pollution mainly because of its wide distribution in the country. Many of the rubber factories and palm oil mills are located in the upland of river basins and an enormous amount of pollution is generated in the preparation of plantation and in raw material processing. About 54 percent of the water pollution complaints received by the Department of Environment (DOE) in 1979 for the entire country were against effluent discharges from rubber factories and palm oil mills. This was followed by 20 percent against other industrial effluent, 10 percent against mining and siltation, 8 percent against piggery wastes and 6 percent against municipal sewage. It has been generally recognized that the relative significance indicated by the number of complaints reflects reasonably well the water pollution situation in the country (Ref. 1).

LAGUNA LAKE WATER QUALITY MANAGEMENT IN THE PHILIPPINES

Laguna Lake is about 15 km southeast of Manila and is known to be the largest freshwater lake in the Western Pacific Region. The lake has an area of 90,000 hectares, a total catchment area of 382 square kilometres, and an average depth of 2.8 metres. The lake is a potential source of water supply for Metro Manila and is presently used mainly for fish culture, irrigation and water transport. The main water quality problem is its high euphotic state with an algal count sometimes as high as half a million per millilitre.

Lake eutrophication is normally controlled by restriction of inflow of phosphorous and nitrogen. Control of phosphorus inflow into the lake is not practical since some of the lake tributaries pass through rock formations with high phosphate contents. Hence, one potential control strategy is to limit nitrogen inflow into the lake. A study was undertaken jointly by the World Health Organization (WHO) and the Government of the Republic of the Philippines in 1975-78 with funds from

the United Nations Development Programme (UNDP) and Asian Development Bank (ADB) as well as from the WHO and the Government. The estimated nitrogen inflow into the lake from different sources for 1975-76 is as follows (Ref. 2):

<u>Source</u>		<u>Nitrogen inflow</u> <u>tonnes/year</u> <u>%</u>	
Agriculture		1,904	48
Swine	627		
Poultry	292		
Other animals	213		
Cropland	772		
Domestic wastes		1,400	36
Industrial wastes		190	5
Miscellaneous		448	11
Total		3,942	100

As indicated in the table, agriculture-related activities contribute the most with industries discharging an insignificant amount. It is, however, important to point out that toxic substances in industrial wastewater are of prime concern in view of the fishery use of the lake and the potential public water supply development for Metro Manila.

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