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## **Latin America in the Seventies: The Geography of Minerals**

The decade of the 1970s can undoubtedly be recorded as the most prolific period to date for publications focusing on the geography of minerals in Latin America. During this period twenty-nine articles, theses, and dissertations were written on this subject or on topics related to it. The average number of publications is still less than three per year. However, this should be viewed with reference to "The Geography of Mineral Production," by Raymond Murphy in 1954, whose bibliography listed only two articles on Latin America that had appeared to that time in the three leading American geographical journals (Murphy 1954, 289-290). Minkel, in reviewing the status of research in this field during the 1960s, identified only five articles and eight theses and dissertations on the subject (Minkel 1971, 209-210). The volume of materials published or unpublished by geographers during the past decade can therefore be seen as a veritable "bonanza" when compared with previous periods.

Publications by geographers on the geography of minerals in Latin America, although numerous during the 1970s as compared with the past, are few relative to research needs or to the contributions by geologists, engineers, economists, and historians. Fortunately, these professionals share with geographers some common interests in mineral production, processing, and transport. Private organizations and government agencies such as international banks, ministries of mines, and the United Nations, have also made significant contributions.

Among the few substantial publications by geographers during the 1970s were three by British scholars. Gerald Manners (1971), in his book on *The Changing World Market for Iron Ore, 1950-1980: Economic Geography*, employed a global perspective to analyze the supply and demand patterns of this commodity. Emphasis was placed on the impact of technological change and political influence. This was followed in 1974 by a book he co-authored with James McDivitt entitled *Minerals and Men*. The themes of this text focused on the place of minerals in modern society, commodity studies, and aspects of uncertainty affecting supply. Throughout, the authors emphasize economic, political, social,

and spatial implications concerning the use of non-energy minerals and metals. The third work, *Mineral Resources*, by Kenneth Warren (1973), details the several factors (e.g., mining technology and mine development) involved in the creation of usable minerals and the major problems of the mining industry generally.

None of the books deal specifically with the minerals geography of Latin America, but many regional studies include segments on the local or regional significance of mining in that part of the world (e.g., Henshall and Momsen, 1974; Fifer, 1972). Such references may aid in understanding the regional economy but do little, by design or intent, to foster the development of concepts and methodology in minerals geography. For this, one must refer primarily to articles in the geographical journals or to graduate theses and dissertations.

## **Articles**

Due to practical considerations, this survey includes only those articles which appear in the professional geographical journals or in the annual or occasional publications of geography departments and geographical societies. No attempt has been made to identify any writings by geographers that may have been published in other scholarly journals.

Using the above format, nineteen articles were found relevant to the subject under consideration. Eighteen of these focus specifically on Latin America, and of the latter, almost half were written by either Vernon C. Mulchansingh or J. Douglas Porteous. Seven articles relate to the mining of copper, six to petroleum, and three to bauxite. Areally, only eight nations are represented, with Chile (6) and Jamaica (2) being the sites of study for half of the publications. Despite the limited total number of articles, three major topics are conspicuous.

The dominant research theme has been the relationship between the mining of minerals and the economy of a region. Seven publications focus on this topic, two of which deal with the bauxite industry of Jamaica. Eyre (1974) analyzed the effect of this industry on the island's traditional social and economic systems, employment prospects, trade patterns, and land values, while Mulchansingh (1971a) described the industry's history and impact on the national economy. In similar fashion, Mulchansingh (1971b) reported on the contributions of the petroleum industry to the economy of Trinidad. This was followed (1975) by a study in which he focused solely on the current impact and problems pertaining to the industry. The impact of relatively recent mineral developments in Latin

America is the topic of two other articles. Fox (1978) described the new oil discoveries in Mexico, and Nentwig Silva and Bandeira de Mello (1975) evaluated current and prospective benefits of the Caraiba copper reserves to the Juazeiro-Petrolina region of Brazil. Another article on mining and the regional economy (Smith, 1976) deals with the economic functional organization of Bolivia and its delimitation through the analysis of commodity flows. Two of the functional regionalizations are for minerals and petroleum products. Oil is the second major topic of attention. Three articles deal with its impact on a region's economy and have been noted as part of theme one. A description of specific oilfields was the focus for Hoempler's (1971) report on eastern Peru and for Eager's (1977) article on Tierra del Fuego. Mulchansingh (1971c), in his in-depth analysis of "The Location of Oil Refining in Latin America and the Caribbean," reported country-by-country on the patterns of oil production and consumption.

A third group of articles is concerned with political power and government policy. Porteous (1973a), using the copper industries in Chile as an example, explains and models those factors that promote the emergence of a company state. Tesar and Tesar (1973) reported on the conditions that precipitated the expropriation by Chile of copper facilities owned by United States concerns. A third article (Bounds, 1974) describes how the Jamaican restoration laws pertain to abandoned bauxite strip mines and the general process of returning mined land to agricultural usefulness.

The remaining studies include a variety of topics, none sufficiently represented to warrant a separate category. Mining in frontier areas is the theme of two articles. Porteous (1973b), using United States mining enterprises in the Atacama Desert for his example, analyzed the corporation as a frontier developer. Craig (1973) was concerned with problems surrounding the development of placer gold deposits in eastern Peru. Two articles by Porteous deal with company towns in Chile. One (1972) reviews the abandonment of Sewell and Caletones and resettlement of their inhabitants, while the other (1974) reveals the social-spatial structure of several company towns. Two additional articles center on the construction of models which can be used to explain mining operations. Employing a simple location theory model, Hay (1976) analyzed the viability of a mine as a function of production costs, transport costs, and market price. The model developed by Aschmann (1970) marks the first attempt by a geographer to provide a theoretical framework for examining a typical mining operation. Using observations and data primarily from the mining industry of Chile, the model

portrays graphically the life history of a mine by focusing on the inter-relationships and changes through time of capital investment, labor applied, and profits from mineral output. This article should be required reading for all students of minerals geography.

## **Theses and Dissertations**

During the decade of the 1970s more than one hundred theses and dissertations dealing with the geography of minerals or related matters were written by graduate students at universities in the United States and Canada. Among the 102 actually identified in this study, seventy theses and thirty-two dissertations, ten deal specifically with Latin America. Of this number five are Master's theses – a reduction from seven in the previous decade. The themes vary in emphasis from locally-developed industry to the impact of multinational corporations. Their areal coverage is limited to the Middle America-Caribbean region.

Among the theses was that of Hallaron (1972), reporting on the Kaiser bauxite operations of Saint Anne's Parish, Jamaica. Bishop used an historical-cultural approach to describe coastal salt-making along the Gulf of Nicoya in Costa Rica. The economic evaluation of a Mexican mining community, Santa Rosalia (Cichowicz, 1973); the spatial aspects of economic development in Venezuela (Wolf, 1975); and the functional change, from extractive industry to market agriculture, affecting a Honduran mining town (Shoemyen, 1979) complete the list of topics covered.

Five dissertations were completed during the 1970s within the topical range of this report, an increase of four over the previous decade. At this academic level the depth of analysis is more profound, and the researcher normally presents a greater wealth of information. Topics of the five dissertations vary from pre-Columbian cement to commodity flows in Bolivia. The focus (three out of five) is, again, Middle America.

For his dissertation research, Hyman (1970) gathered stucco, mortar, and concrete from eighteen prehispanic Mesoamerican sites. He studied the source and techniques of manufacture, and dated the origin of American cement making as 1 A.D. The dynamic organization of the Bolivian economy was functionally delimited by South (1972) using an analysis of commodity flows. He found that the spatial structure of the economy depends upon the type of commodity which dominates the flow patterns. In traditional "Berkeley School" methodological

fashion, Baxter (1975) studied the small-scale diamond miners of Poxorco, in Brazil. The remaining two dissertations focus on mining in Central America. The economic geography of mining in Honduras was the theme of a dissertation by Thompson (1973). Attention was given to the problems that negatively affect the efficiency, competitive position, and growth of that nation's mining industry. The author concluded by suggesting programs and policies needed if mineral development is to be accelerated. Driever (1977) studied the EXMIBAL nickel mine in Guatemala and its impact on the workers, region, and country, while evaluating the relationships between large-scale mining and economic development.

## **Research Needs and Opportunities**

Considering the relative dearth of literature on minerals geography as it pertains to Latin America, there is obviously an abundance of subjects available for meaningful research. Despite the limited research conducted to date, some optimism can be gained from the investigative efforts by geographers during the 1970s. Encouraging signs are the efforts by graduate students to fill research voids, some work to identify and analyze distributional patterns, the development of model building, and the increased total number of publications. Despite this beginning, the research needs outlined for the 1970s (Minkel, 1971, 211-212) can be reiterated for the eighties.

First, there remains a need for an up-to-date inventory of existing mineral industries, problems, and development potential for each major Latin American country or region. Several governments have already given some attention to this matter. The Brazilian Ministry of Mines and Energy has published an excellent series of bulletins (e.g., Brazil 1973c and 1973d) that provides an inventory of each major mineral found within the national boundaries. Some books (e.g., Brazil 1973a and 1973b) focusing on the spatial, economic, and geological aspects of Brazil's mineral wealth have also been published by other departments of the government. Another substantial work, *Natural Resources in Latin American Development*, by Joseph Grunwald and Philip Musgrove (1970), employs detailed statistical data in the analysis of the resource base, production, consumption, and trade in the principal primary industries of Latin America. Such publications have helped to develop the beginnings of a regional minerals inventory, but there remains a serious need for more studies such as those of Manners (1971) and Mulchansingh (1971c). In-depth investigations such as these on the spatial distribution of other types of mining and processing activities in Latin America,

long overdue, are basic to geographic tradition. Attention should also be focused on the role of escalating market prices in relation to potential resource development, which would provide information useful to Latin American policymakers and planners.

The need for more research to measure the impact of mineral-based activities upon the local landscape, economy, politics, and people was identified as a high-priority item among opportunities in the 1970s. As became evident in the present survey, scholars did direct their attention toward this theme; but with only eight such works published one can hardly describe such efforts as a major thrust. It is particularly notable that, in contrast to conditions in Anglo-America, no investigations were identified as having a predominant focus on environmental pollution. More attention should also be given to Aschmann's model, including questions such as how stages in the historical cycle of a mine might affect the findings of impact studies. During the 1980s efforts should be made not only to increase the output of existing types of research but also to promote the development of simple models. Systems analysis might be employed in formulating such models, giving the resultant research greater direction and comparability.

The development of theory and utilization of computer technology was also suggested ten years ago as a desirable goal. Several investigations during the 1970s followed that orientation, but current methodology appears limited largely to historical review, personal observation, and simple compilation of data from company and government records. The use of simulation models (e.g., Jones, 1969) could be quite rewarding not only in studying the impact of a particular industry but also in directing research efforts toward an understanding of process. The models presented by Aschmann (1970) and Hay (1976) offered for the first time a theoretical framework for the examination of mining operations. Geographers should seek to develop new explanatory models from within their own discipline and also look to related disciplines for models which might be borrowed and adapted to a spatial perspective. The need is to search for methods of revealing more clearly the role and dynamics of the mineral industries in modern society.

One recommendation of the previous ten-year summary report, the dissemination of information acquired in Master's degree research, has not been implemented. The limited total number of publications on the minerals geography of Latin America highlights the need for maximum utilization of those that exist. Efforts

should be exerted by academic advisers to assure ample circulation of theses in some printed form. At a minimum, the findings should be presented at professional meetings. Joint authorship may be a useful device to facilitate publication. Until some procedure is found, approximately three-fourths of all research effort in the minerals geography of Latin America will benefit only a small number of individuals. The problem is obviously not unique to this subfield, but its solution should be initiated somewhere.

It is almost certain that minerals will play an increasingly important role in the development of Latin America in the decades ahead. For the Latin Americanist geographer seeking involvement in significant research, the minerals industry offers ample opportunities.

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