

**Clarence W. Minkel**  
*Michigan State University*

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

Considered apart from other aspects of commercial primary activities, the geography of minerals would be recognized readily as a neglected field. The situation today remains little changed from that of nearly two decades ago, when Raymond E. Murphy (1954) wrote that "studies in the geography of mineral production that can be credited exclusively to geographers have been sporadic." Not more than ten mineral articles had appeared to that time in *The Geographical Review*, fewer in the *Annals of the Association of American Geographers*, and not many more in *Economic Geography*. His bibliography listed only two entries dealing with Latin America, both by Robert S. Platt.

It is fortunate that professions such as geology, engineering, economics and history share with geography some interest in mineral production, processing and transport. The dearth of geographical literature is thus compensated to some extent by publications in related disciplines. Especially valuable sources of data are the publications of the United States Bureau of Mines, such as the *Minerals Yearbook*, *Mineral Facts and Problems*, and *Mineral Trade Notes*. United Nations bulletins are also useful, as are those of international banking agencies. Trade associations publish a relative wealth of information, the Oil and Gas Journal being one of the numerous outlets. Among the few substantial publications on minerals by geographers during the decade of the 1960's is *A Geography of Minerals* (Voskuil, 1969). While the latter is a general volume, of small size and world-wide scope, its bibliography is useful to the researcher with a geographic interest in minerals. Yet, only three entries pertain to Latin America.

For studies dealing with the mineral geography of Latin America, one must turn primarily to articles in geographical journals and to graduate theses and dissertations. During the decade of the sixties these totaled slightly more than a dozen items, or just over one per year.

### **Articles**

Journal articles on the geography of minerals in Latin America are too few in number to be classified in a meaningful way according to type. A really, they are

concerned with topics widely dispersed, from Mexico and Jamaica to Argentina and Peru. Each covers a single mineral commodity in a given country or attempts an over-all review of a nation's mineral or power resources.

Seawall's report (1961) on recent developments in the Mexican sulphur industry provides information on such aspects as location, historical background, general geological structure, reserves, volume of production, processes, current trends and prospects for the future. Young (1965) incorporates an additional dimension in his review of bauxite mining and processing in Jamaica, presenting an evaluation of the industry's impact upon the local economy and people. Argentina's changing industrial resource base is analyzed by Rau (1962), following his previous line of research on the electric power industry of East-Central Brazil (1960).

Hoy and Taube (1963) evaluated the power resources of Peru and found that long-accepted generalizations about the inadequacies of fuel and other power resources in Latin America are to a large degree inapplicable to that country. New mineral discoveries, the mining of low grade deposits, and improved techniques of processing and transport are among the agents of change that have gradually eroded the validity of some standard assumptions in the geography of minerals. The authors suggest the need for similar research in other countries of Latin America to provide a reevaluation of power resources in the light of modern conditions and technology.

Research on the geography of mineral production leads, logically, into some aspects of processing and manufacture. C. Langdon White, working with a number of graduate students, has generated an interesting series of studies on the iron and steel industries of Latin America. Included are analyses of the iron and steel industry of Colombia (White and Alderson, 1956), Peru (White and Chenkin, 1959), and Chile and Argentina (White and Chilcote, 1961; Chilcote, 1963). In each case the iron and steel complex of the nation is evaluated in relation to its resource base, transportation, markets and economic viability. The uniformity of approach provides a basis for comparison not commonly found within the geographical literature.

Although few articles in recent years have dealt specifically with mineral geography in Latin America, many regional studies have included segments on the local or regional significance of mining (e.g. Miller, 1965; Kearns, 1969). Such references may aid in understanding the regional economy, but they are not

designed or intended to contribute to the concepts and methodology of mineral geography.

### **Theses and dissertations**

At least seven master's theses have been written during the decade of the sixties that deal at least generally with the geography of minerals in Latin America. They cover an ample variety of themes as well as geographic area. The countries that serve as foci for the studies are largely those in which minerals constitute a major segment of the national economy or are of rapidly increasing importance. Unfortunately, not all of the theses are based upon direct field investigation. Most are of a summary, descriptive nature.

Appropriately, much of the minerals research by graduate students has been concentrated on Chile, but study has also been conducted on Mexico, Colombia, Bolivia and Argentina. These topics have included the single-industry, multi-industry, and regional approach. Swartz (1962) reported on recent developments and prospects in the Chilean copper industry, while Cermakian (1964) gave special attention to the cement industry in his transportation and industrial location analysis of the central region of that country. Willett (1965) provided a general geographic survey of the economy in Chile's arid north. The Mexican petrochemical industry (Eason, 1967). Colombia's iron and steel industry (Birbragher, 1965), the mining industry of the Bolivian Highlands (Shiller, 1966), and the energy resources of Argentina (Carnell, 1962) provided the remaining thesis topics.

A single doctoral dissertation highlights the graduate student contribution to the mineral geography of Latin America during the decade. This study of the Norte Chico of Chile (Pederson, 1965) focuses upon the mining industry, which provides the "most conspicuous and distinguishing quality of the region." A historical geography, the dissertation is based upon a combination of meticulous library and field research which has come to characterize the "Berkeley school" of geography. Unlike the master's theses, this work is available for distribution in published form, through the Northwestern University Studies in Geography.

### **Research needs and opportunities**

In a field that is little developed there is obviously much useful work that can be done. It would be a valuable contribution to knowledge if, for example,

geographers were to provide an up-to-date inventory of the existing mineral industries, problems, and potential mineral resource development for each of the major Latin American countries or regions. Judging from research completed during the 1960's, it seems appropriate that special attention be given during the next decade to Central America and Brazil. The potential significance of Central America as a mineral producing region is attested to by the fact that the United Nations Development Programme is presently, or has been recently, engaged in major pre-investment mineral projects in every Central American nation. The increasing exploitation of Brazil's vast mineral reserves is reflected by a 56 percent increase in the value of that nation's mineral exports during the six-year period 1961-1967 (CEPAL, 1970).

With the rapid development of mineral resources throughout Latin America in recent years, there is need for numerous studies which would measure the impact of such activities upon the local landscape, economy, politics and people. Conversely, there is much to be learned about the effects of a dying mineral industry when reserves are depleted or cease to be economical to exploit. In either case, research in mineral geography should not fall exclusively to the economic geographer. It would be especially commendable if geographers were to produce in-depth research on a given mining enterprise or national industry, such as have been published by the historians Whitaker (1941), on the Huancavelica mercury mine of Peru, and Lieuwen (1955), on the petroleum industry of Venezuela. On a broader theme, one might also wish for a modern version of Whitbeck's *Economic Geography of South America* (1926), in which the geography of minerals received prominent consideration.

Although much statistical data is available on the mining industries of the various Latin American countries, there has been virtually no use in mineral geography of computer techniques. The development of theory has hardly yet been attempted, and methodology seems limited largely to historical review, compilation of data from company and governmental records, personal observation and interviews with management personnel. Cartographic representation in mineral geography has developed little in recent years, since the basic problems involved seem as insoluble as the proverbial difficulty of portraying accurately the round earth on a flat map.

For Latin Americanist geographers teaching in the universities, careful consideration should be given to the status and trends of master's degree programs in graduate education. This brief review of but one small segment of

Latin American geography suggests that the master's thesis, aside from its benefits to the individual primarily involved, may contribute far more to the total geographic literature than is commonly recognized. If such is actually the case, we might well do what we can to preserve these programs and to enhance their quality. If the master's theses, in turn, are of significant quality, special effort should be exerted to see that they appear and circulate in print. At present, single copies are commonly presented to the respective advisor, department and/or library, with little or no provision for their circulation at large.

It is concluded that the decade of the sixties represents a series of lean years in the geography of minerals in Latin America. Prospects for the seventies may, however, be brighter. Noteworthy is an article by Aschmann (1970) on "The Natural History of a Mine," using data and observations primarily from the mining industry of Chile. It provides, for the first time a theoretical framework, through a set of models, for examination of the typical mining operation and offers recommendations useful in the establishment of public policy. Hopefully, this work will stimulate additional research of both theoretical and practical nature. In any event, it seems clear that the field of mineral geography represents a veritable "gold mine" of opportunity for the Latin Americanist geographer in the decade of the seventies.

## **REFERENCES CITED**

Aschmann, Homer. "The Natural History of a Mine." *Economic Geography*, Vol. 46, No. 2, pp. 172-189, (1970).

Birbragher, L. "Colombia's Iron and Steel Industry." (University of Chicago, Department of Geography, Master's Thesis, 1965.)

Bullard, F.J. *Mexico's Natural Gas*. (Austin: University of Texas Studies in Latin American Business, No. 5, 1968).

Carnell, T.E. "Energy Resources in Argentina: Types, Regional Patterns, and Significance to the Economy." (Columbia University, Department of Geography, Master's Thesis, 1962.)

CEPAL. *Notas sobre la economía y el desarrollo de America Latina*, No. 34, (1970).

Cermakian, J. "Transportation and Industrial Location in Central Chile, with

Special Reference to the Cement Industry." (University of California at Berkeley, Department of Geography, Master's Thesis, 1964).

Chilcote, R.H. "Integrated Iron and Steel Industry for Argentina." *Inter-American Economic Affairs*, Vol. 16, No. 4, pp. 31-46, (1963).

Eason, A. "The Mexican Petrochemical Industry." University of Michigan, Department of Geography, Master's Thesis, 1967).

Hoy, D.R. and S.A. Taube. "Power Resources of Peru." *The Geographical Review*, Vol. 53, No. 4, pp. 580-594 (1963).

Kearns, K.C. "Amazonia: The Emergence of Brazil's Northern Frontier." *Journal of Geography*, Vol. 68, No. 9, pp. 535-544, (1969).

Lieuwen, E. *Petroleum in Venezuela: A History*. (Berkeley: University of California Press, 1955.)

Miller, E.E. "The Guayana Region, Venezuela: A Study in Industrial and Urban Development." *Yearbook, Association of Pacific Coast Geographers*, Vol. 27, pp. 77-89, (1965).

Murphy, R.E. "The Geography of Mineral Production," in *American Geography: Inventory and Prospect*. (James, P. E. and Jones, C.F., eds.), Syracuse: Syracuse University Press, 1954.

Pederson, L.R. "The Mining Industry of the Norte Chico, Chile." (University of California at Berkeley, Department of Geography, Ph.D. Dissertation, 1965.)

\_\_\_\_\_. *The Mining Industry of the Norte Chico, Chile*. (Evanston: Northwestern University Studies in Geography, No. 11, 1966.)

Rau, H.L., Jr. "The Electric Power Industry of East-Central Brazil." *Abstract, Annals of the Association of American Geographers*, 50: 343-344, (1960).

\_\_\_\_\_. "Argentina's Changing Industrial Resource Base." Abstract, *Annals of the Association of American Geographers*, Vol. 52, pp. 355-356, (1962).

Schiller, W.E. "The Mining Industry of Bolivia's Highlands." (University of Oklahoma, Department of Geography, Master's Thesis, 1966.)

Seawall, F. "Recent Developments in Mexican Sulphur Production." *The Journal of Tropical Geography*, Vol. 15, pp. 39-45, (1961).

Swartz, R.D. "The Chilean Copper Industry: Recent Developments and Prospects." (Columbia University, Department of Geography, Master's Thesis, 1962.)

Thompson, N.R. "The Mining Industry of Honduras." (East Lansing, Unpublished paper presented at meetings of the East Lakes Division, Association of American Geographers, 1969.)

Voskuil, W.H. *A Geography of Minerals*. (Dubuque: Brown, 1969.)

Whitaker, A.P. *The Huancavelica Mercury Mine: A Contribution to the History of the Bourbon Renaissance in the Spanish Empire*. (Cambridge: Harvard University Press, 1941.)

Whitbeck, R.H. *Economic Geography of South America*, 3rd. ed., (New York: McGraw-Hill, 1940).

White, C.L. and Alderson, D.J. "Steel and Symbolism at Paz del Rio." *Inter-American Economic Affairs*. Vol. 9, No. 4, pp. 82-94, (1956).

White, C.L. and Chenkin, G. "Peru Moves onto the Iron and Steel Map of the Western Hemisphere." *Journal of Inter-American Studies*, Vol. 1, pp. 377-386, (1959).

White, C.L. and Chilcote, R.H. "Chile's New Iron and Steel Industry." *Economic Geography*, Vol. 37, No. 3, pp. 258-266, (1961).

Willett, C.L. "The Economy of Chile's Arid North: A Geographic Survey." (University of Oklahoma, Department of Geography, Master's Thesis, 1965.)

Young, B.S. "Jamaica's Bauxite and Alumina Industries." *Annals of the Association of American Geographers*, Vol. 55, No. 3, pp. 449-464, (1965).