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Ceramic provenance and the regional organization of pottery production during the later Formative periods in the Valley of Oaxaca, Mexico: Results of trace-element and mineralogical analyses

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ABSTRACT

The Valley of Oaxaca, Mexico represents an extremely complex geological context for ceramic provenance studies. Here we utilize this complexity to establish a fine-grained ceramic geography for the central portion of the valley, by combining extensive raw material survey with chemical and mineralogical characterization of clays and pottery. Trace element analyses of 320 field clays and 500 vessels distinguish twelve different areas that were actively producing ceramics during later Middle through Terminal Formative times (700 BCE–200 CE). These detailed provenance determinations provide a means to track changes in the organization of ceramic production at the core of the emerging Zapotec state, and contribute fresh insights to long-standing economic questions - such as the rise of early market systems - in the Valley of Oaxaca.

1. Introduction

In this study we address the challenge of establishing ceramic provenance at a spatial scale useful for shedding light on intra-regional networks of production and exchange within the Valley of Oaxaca during the later Middle through Terminal Formative. Situated in the highlands of southern Mexico, the Oaxaca Valley represents one of our best documented cases of primary state formation, consolidation, and decline in the New World (e.g., Blanton et al., 1999; Joyce, 2010; Marcus, 1998, 2008; Marcus and Flannery, 1996; Spencer, 2010; Spencer and Redmond, 2004). Current models of political and economic processes in the ancient Zapotec state continue to stress intra-valley interactions, placing a high premium on being able to monitor production and exchange at the local level. Such a focus requires that we distinguish source areas and track the movement of ceramic vessels over shorter distances, which in turn requires finer-grained spatial data and a more detailed understanding of raw material resource distributions.

Our goal here is to define and describe the "ceramic geography" for the central Oaxaca Valley, i.e., where ceramics were produced and the spatial resolution obtained in mapping those sources. Prior trace-element analyses of Formative ceramics have largely focused on the role of inter-regional trade in pottery vessels. These studies have illustrated that ceramics from important early centers in the valley can be distinguished from those of neighboring highland areas, as well as from both the Pacific and Gulf coasts, and have indicated that ceramic vessels moved over long distances, although the specific mechanisms varied by time period and region (Blomster et al., 2005; Herrera et al., 1999; Joyce et al., 2006; Redmond and Harbottle, 1983; cf. Stoltman et al., 2005). However, these studies have not explored chemical and mineralogical variation within the Valley of Oaxaca to any great extent, and are not sufficiently detailed to address issues of exchange at the intra-regional level. Yet such a scale is necessary to examine long-standing questions – such as the organization of craft production and the rise of early market systems – in the Valley of Oaxaca.

In order to provide a more comprehensive view within the Valley of Oaxaca, we initiated a program of extensive raw material sampling, trace-element characterization, and petrographic analyses of field clays to establish a robust, regional framework for monitoring ceramic exchange within the region (Minc and Sherman, 2011). Here we apply this regional perspective to the task of identifying the probable sources of ceramic production within the heartland of the early Zapotec state during the later Middle through Terminal Formative periods (700 BCE–200 CE), a time span marked by centralization of political

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control under the new regional capital at Monte Albán (Balkansky, 1998; Elson, 2007; Marcus and Flannery, 1996; Spencer and Redmond, 2001, 2004; Sherman et al., 2010). The result is a relatively fine-grained assessment of ceramic provenance that will support detailed re-analyses of long-standing models for the emergence of specialized production and intra-regional exchange during the early stages of Zapotec state formation.

1.1. Background: regional clay characterization

The Valley of Oaxaca is a high intermontane valley situated at ca. 1500 m and sharply bounded by the steep topography of the Sierra Madre del Sur. Bedrock is at or near the surface through much of the surrounding uplands, and differences in bedrock composition strongly affect the mineral content and chemistry of valley clays (Fig. 1). As

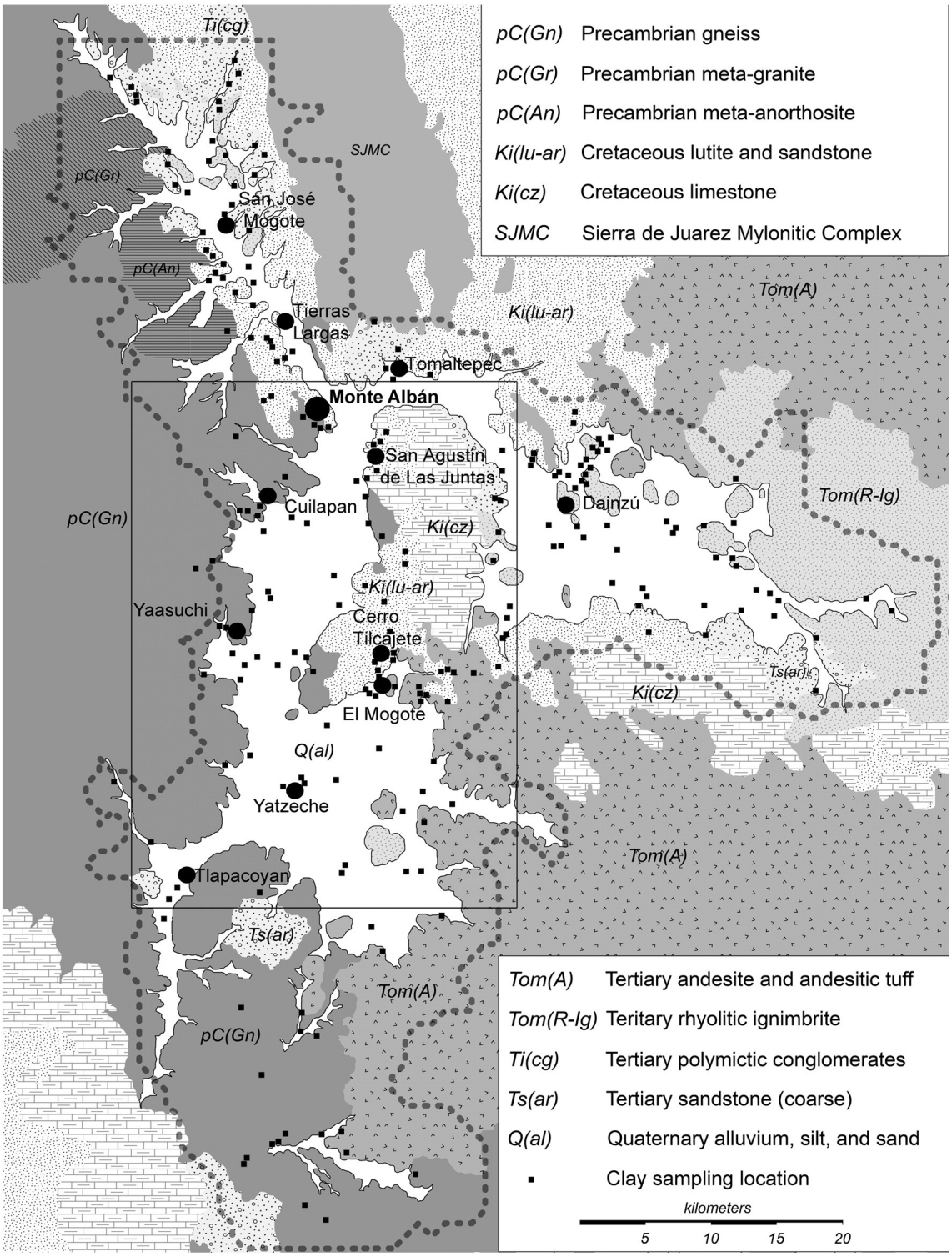

Fig. 1. Geological map of the Valley of Oaxaca, Mexico showing major bedrock units influencing clay composition, as well as clay sampling locations, and major sites mentioned in the text. Dashed line marks approximate boundary of Oaxaca settlement surveys. Inset rectangle indicates spatial focus of this study.