were found. These can be and have been dated independently of the petroglyphs in some cases, including in Bolivia.) Finally, there is a series of minor qualifications, such as those concerning the type(s) of crystalline quartz present at the site, which was not determined. It would be too complex to elaborate on the potential effects of each of these qualifications, but in considering them realistically I arrive at the conclusion that there is a very high probability that the true age of the polished surface in question, *i.e.*, the time it was last treated, lies between E730 and E1330 years BP. If a calibration curve for the region were determined, the error margin would be quantified, and it would be very significantly reduced if two mineral components could be calibrated and analyzed.

This may seem a rather large tolerance factor but this result is, nevertheless, invaluable as a first building block in constructing a sound chronology for central Bolivian petroglyph traditions. The recent petroglyphs at Inca Huasi show a cement retreat of more than three times that in the polished surfaces, which suggests that they may be in the order of two to three times as old (the solution of the cement is thought to increase with progressing recession). Therefore we can estimate the linear petroglyphs and arranged cupules on the sandstone slope to be roughly between 1500 and 4000 years old.

Unfortunately we cannot extrapolate in a similar fashion to the age of the random cupules on the quartzite dyke of Inca Huasi, because of the significantly different lithology and the absence of any quantitative microerosion data for this tradition. However, that tradition seems almost as old as the time when the dyke was initially exposed by fluvial action. While this provides no numerical value of age, the dyke may have been first exposed during the final Pleistocene or early Holocene. The main problem with estimating the antiquity of the early cupules is that we cannot be sure whether their spatial restriction to the resistant quartzite is a taphonomic phenomenon, although this is suggested to be the case. If it were thus attributable to selective survival, *i.e.*,if similar cupules on the soft sandstone have entirely eroded, then this tradition is very likely to be of the final Pleistocene. If this assumption is incorrect, the early cupules of Inca Huasi would most probably be of the early Holocene.

For the time being this matter cannot be resolved but we note the recent discovery of very archaic petroglyphs in Cueva Epullán Grande, Argentina, which appear to be of the late Pleistocene (Crivelli M. and Fernández 1996). It is to be expected that further such archaic petroglyphs, which often include cupules, will be identified in the Americas, and I predict that they will be found either in well-sheltered locations (*e.g.*, caves) or on extremely weathering-resistant rock (primarily quartzite). It is to be noted that taphonomically determined attribute profiles of extremely old petroglyph traditions in other continents consistently comply with this logical prediction. The oldest known petroglyphs in the world occur on fully metamorphosed quartzite in deep caves (Bednarik 1993b; Kumar 1996), in the form of cupules.

I believe that the above information concerning the apparent antiquities of the three use phases of Inca Huasi, however limited and vague, provides reliable first glimpses of the ages of petroglyph traditions in the central Bolivian mountains — provided that these data are used with the appropriate restraint, and are not archaeologically misinterpreted.

Acknowledgments

I thank Roy Querejazu Lewis for his enthusiastic support of all my research work in Bolivia, and for taking me to Inca Huasi on two occasions. My thanks are also due to the three referees of this paper for their constructive comments.

References Cited

Bednarik, Robert G.

1988 El arte rupestre Boliviano visto desde el exterior. *SIARB Boletín* 2:22-28.

1992 A New Method to Date Petroglyphs. *Archaeometry* 34(2):279-291.

1993a Geoarchaeological Dating of Petroglyphs at Lake Onega, Russia. *Geoarchaeology* 8(6):443-463

1993b Palaeolithic Art in India. *Man and Environment* 18(2):33-40.

1994 Conceptual Pitfalls in Palaeolithic Rock Art Dating. *Préhistoire Anthropologie Méditerranéennes* 3:95-102.

1995a The Age of the Côa Valley Petroglyphs in Portugal. *Rock Art Research* 12(2):86-103.

1995b The Côa Petroglyphs: An Obituary to the Stylistic Dating of Palaeolithic Rock-art. *Antiquity* 69:877-883.

1996 Only Time Will Tell: a Review of the Methodology of Direct Rock Art Dating. *Archaeometry* 38(1):1-13.

Crivelli Montero, Eduardo and Mabel M. Fernández

1996 Palaeoindian Bedrock Petroglyphs at Epullán Grande Cave, Northern Patagonia, Argentina. *Rock Art Research* 13:124-128.

Kumar, Giriraj

1996 Daraki-Chattan: a Palaeolithic Cupule site in India. *Rock Art Research* 13:38-46.

Querejazu Lewis, Roy, editor

1992 *Arte rupestre colonial y republicano de Bolivia y paises vecinos*. Contribuciones al Estudio del Arte Rupestre Sudamericano 3, La Paz: Sociedad de Investigación del Arte Rupestre de Bolivia.

Watchman, Alan

1995 Recent Petroglyphs, Foz Côa, Portugal. *Rock Art Research* 12(2):104-108.

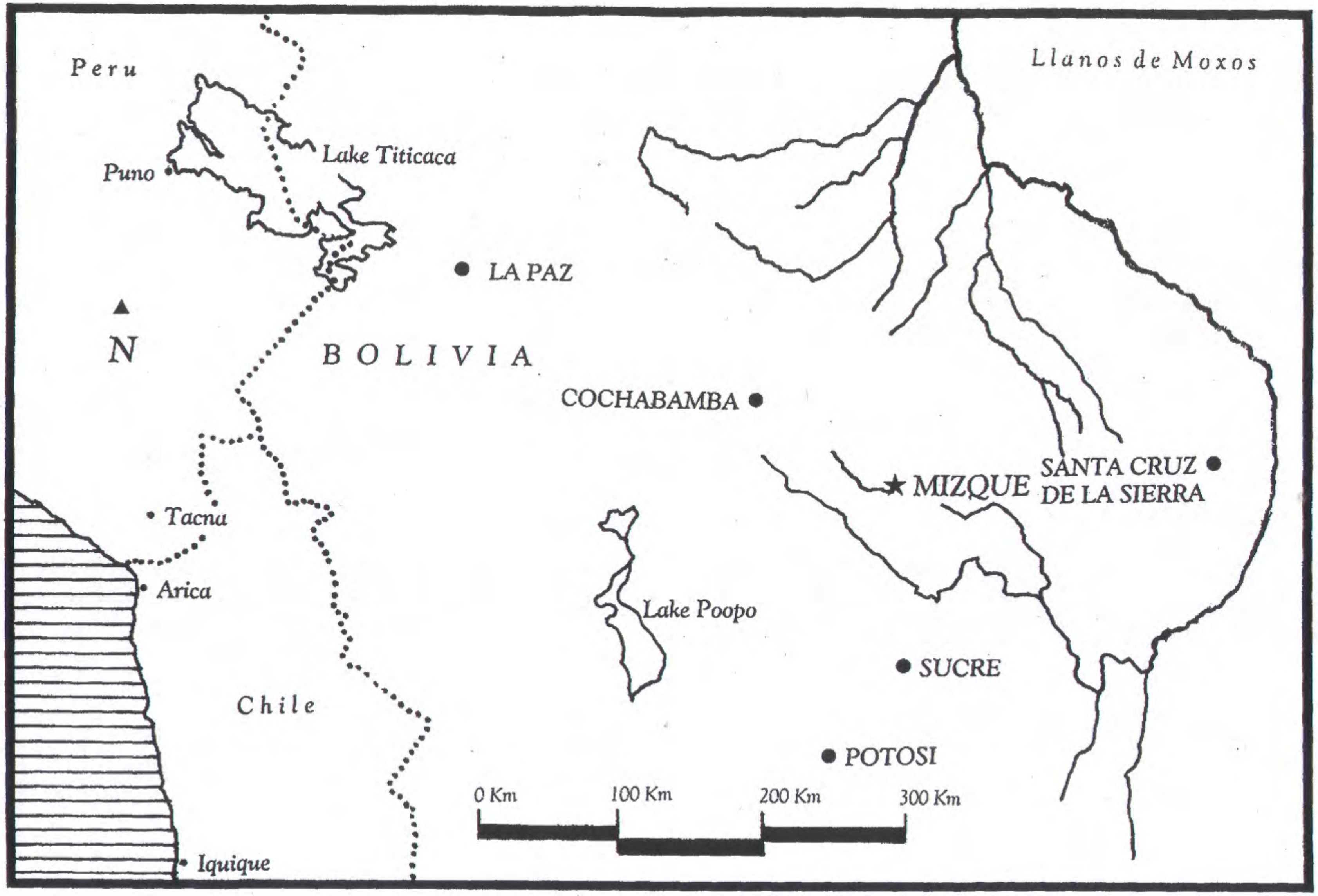

Figure 1. Map of southern Bolivia to show location of Mizque. Inca Huasi is 3 km from Mizque.

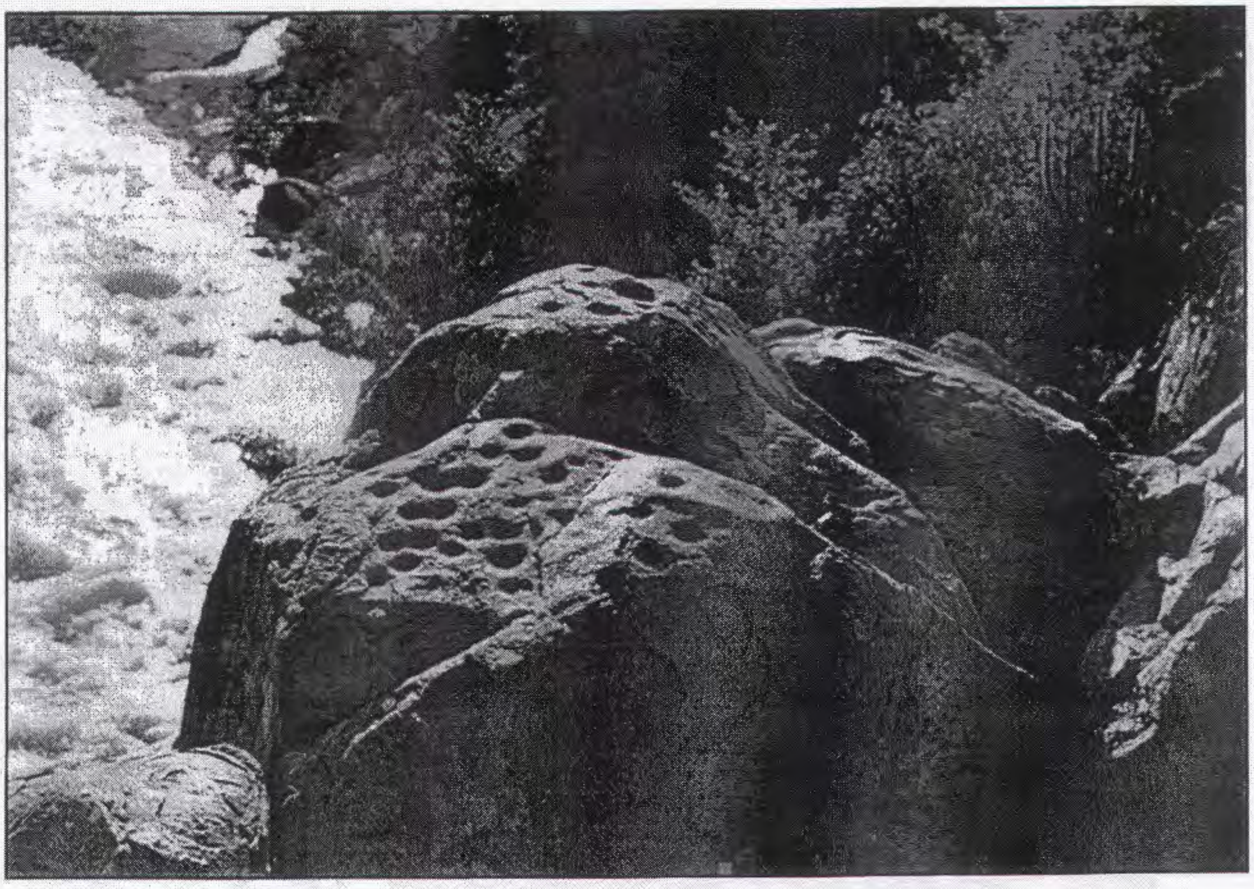

Figure 2. Cupules on the top of the quartzite dyke, with the Uyuchama River visible below. Inca Huasi petroglyph site, central Bolivia.

Figure 3. Impact mark on vertical edge of the quartzite dyke, with radial lines clearly visible. The impact is due to fluvial action. Inca Huasi.

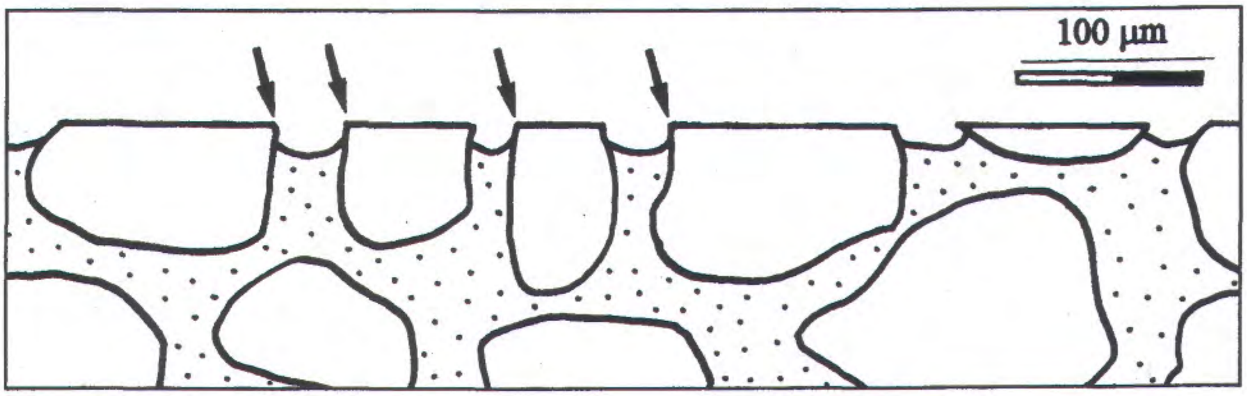

Figure 4. Schematic section through polished dish surface at Inca Huasi, showing the abrasion-truncated quartz grains, the retreating amorphous silica cement, and the locations (arrows) of micro-wanes measured for analysis.

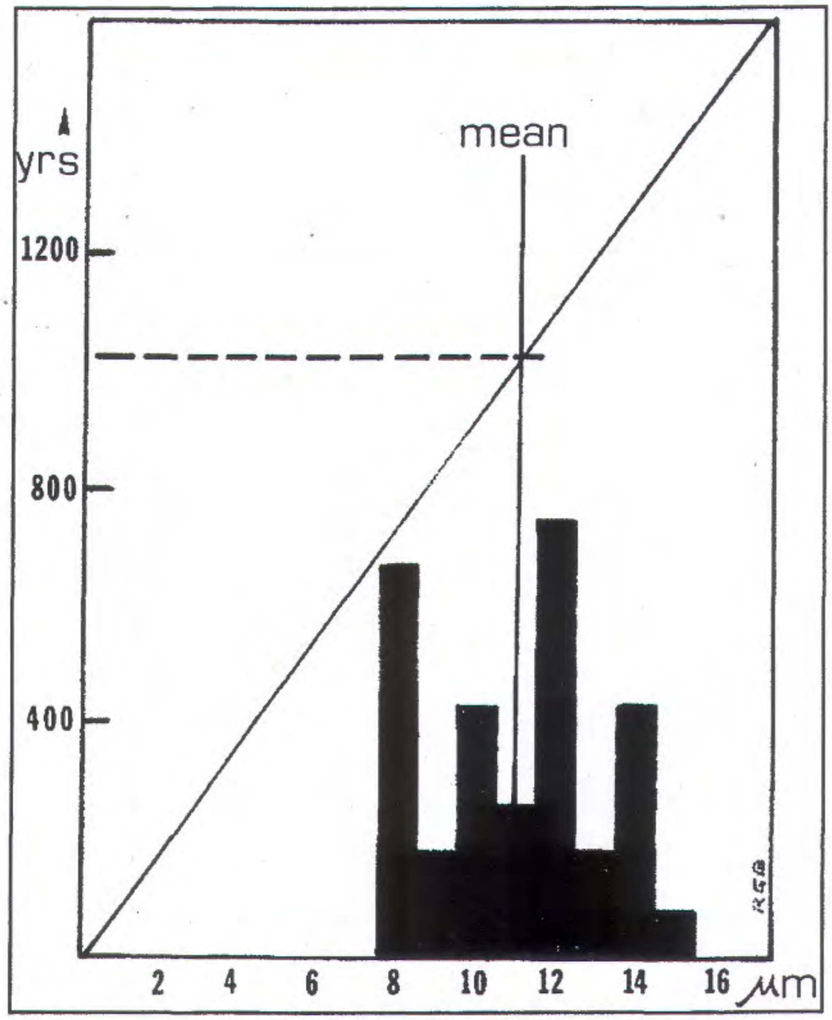

Figure 5. Histogram of 35 micro-wane widths from the polished surface analyzed at Inca Huasi, projected onto the Grosio calibration curve for crystalline quartz.