

SLIP CASTING: A CERAMIC TECHNIQUE INVENTED IN ANCIENT PERU

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Slip casting (French coulage) is a potter's term for a technique which, on the one hand, permits the precision manufacture of ceramic objects and, on the other, lends itself to mass production. This technique was invented in Europe in the 18th century and became an important industrial process in the 19th. I propose to show that slip casting had been invented independently some eighteen hundred years earlier in ancient Peru, where it was applied to the precision manufacture of panpipes.¹

In slip casting, pottery objects are formed by pouring slip, a syrupy suspension of clay in water, into absorbent molds of fired clay or plaster. Water is drawn by capillary action out of the slip into the pores of the absorbent mold, forming a shell of hardened clay on the inner surface of the mold. After a few minutes, when the shell of clay reaches the desired thickness, the remaining slip is poured out, and the shell is left to dry enough to shrink and pull away from the mold. Then it is easily removed, provided there are no snags or projections in the formed piece.²

The invention of slip casting in Europe is generally stated to have taken place between about 1730 and 1750, but little is known of the circumstances. An English potter, Ralph Daniel of Corbridge, is said to have learned the method of slip casting in plaster of Paris molds somewhere in France and to have introduced it to England about 1745.³ I have been able to find no French records of the beginnings of slip casting, but there is no reason to suppose that the method had been in use long when Ralph Daniel learned it. In the 1730's, English potters developed a porous clay mold suitable for either press molding or slip casting; whether the clay mold was actually used for slip casting before the introduction of the French process is not clear.⁴

The industrial possibilities of the slip casting process were slow to be recognized in France.⁵ In England, however, slip casting was quickly applied to the production of stoneware in quantity to meet an expanding market resulting from the growing popularity of tea drinking. In the 19th century slip casting became an important process in the mass production of English white earthenware imitations of porcelain for an enormous market in cheaper domestic crockery and dinnerware. Slip casting has become somewhat less important in the ceramic industry of the present day, because of the development of machine extrusion and stamping processes.

In Peru, slip cast panpipes begin to appear in archaeological sites on the coast sometime in the latter part of the Early Horizon. On the south coast, where we have the most precise dating and the best documentation of the specimens, slip cast panpipes first appear in the ninth of the ten epochs into which the Early Horizon is subdivided, associated with pottery of Phase

9 of the Ocucaje style ("Paracas Cavernas" of the older literature). This association implies a date not later than the turn of the Christian era. Present evidence is not adequate to determine the place of origin of slip casting, but the elaborate development of slip cast panpipes at an early date on the south coast suggests a certain probability that the invention was made there.

Ancient Peruvian pottery panpipes consist of a series of tubes which are made separately and stuck together by adding clay on the outside (fig. 1). In some periods the tubes were perfectly straight and of uniform diameter from one end to the other, while at other periods they were segmented, consisting of sections of different diameters (fig. 2). The slip casting process was used only to make the tubes; the joining and finishing was a separate operation done by hand.

My conclusion that the Peruvian panpipe tubes were slip cast is based upon investigations in the field and museum laboratory, in the course of which I observed minute details of fabrication with a microscope and experimented with duplication of the process. There are two characteristics of the tubes which show that they were made by slip casting: untouched inner surfaces and thin walls of uniform thickness. These features are incompatible with the explanation, suggested by some casual observers of panpipes, that the tubes were modeled around canes. They are effects which could be produced only by the slip casting process.

The tubes of many panpipes, especially those belonging to Phase 10 of the Ocucaje style at Ica, show extensive inner surfaces without a trace of contact with any object. Untouched clay surfaces, such as are found on the interior face of slip cast pieces, are uniform, matte, and slightly nubby due to uneven shrinkage around fine particles of sand or impurities contained in the slip (fig. 3). The exterior of a casting, in contrast to the interior, shows marks from having been shaken out of the mold and handled. Each method of finishing pottery leaves its characteristic traces; a surface that has been rubbed with a smooth stick or a pebble is flat and glossy, while a surface wiped with a cloth shows striations.

Not all panpipe tubes have untouched interior surfaces, for some appear to have been swabbed out with a bit of cotton on a stick. Also, where segmented tubes with sections of different diameter have been joined, distinct marks show where a tool was inserted through the end of the tube to smooth the inside of the joint.

All pottery panpipe tubes have relatively thin walls of uniform thickness. The thickness varies from one style to another but in extreme cases may be a little thicker than a stout eggshell. Thin walls of uniform thickness are a normal feature of slip cast pottery. It would be virtually impossible to duplicate this effect in tubes by any process of modeling or press molding.

In his excavations of terminal Early Horizon habitation refuse at

Jahuay on the south coast in 1956, Edward P. Lanning found not only many panpipe fragments but also tubular pottery molds appropriate for the fabrication of panpipe tubes. These molds are hand modeled, of uneven thickness, and for this reason easily distinguishable from the slip castings made in them (fig. 4). I have succeeded in obtaining slip castings from one of these molds which resemble the ancient panpipe tubes in every detail.

It is possible that some tubular bottle spouts were made by slip casting, but there is no evidence that the use of the technique was extended in ancient Peru to the formation of whole vessels or other pottery objects. It was primarily a specialized technique for the manufacture of panpipe tubes. As such, however, it had a considerable distribution in space and time. Panpipes with slip cast tubes were made all along the south and central coasts of Peru from Acarí to Supe, beginning in Epoch 9 of the Early Horizon and ending on the south coast with Epoch 7 of the Early Intermediate Period, a span of six or seven hundred years. After Epoch 7 of the Early Intermediate Period pottery panpipes were no longer made, and slip casting became a lost art.

The first pottery panpipes on the south coast appear at the same time that several other pottery musical instruments are first found, the others being drums, trumpets, ocarinas, and whistles. Examples of some of these instruments, in the Nasca style of the Early Intermediate Period, are illustrated in fig. 5. Making musical instruments out of pottery was not just a matter of idle fashion; the plastic medium made it easier to control pitch and produce instruments in matched sets. The manufacture of panpipe tubes by slip casting facilitated the production of tubes of uniform diameter.

William W. Suggs, at the College Conservatory of Music, University of Cincinnati, has made a study of the musical characteristics of south coast panpipes which documents the concern of the instrument makers with precision of pitch.⁶ Suggs found that a series of improvements was made in the form of panpipes from Phase 9 of the Ocucaje style to Phase 3 of the Nasca style including modification of the apertures and number of tubes. By the time of Phase 3 of the Nasca style panpipes were produced which could play several modes of the pentatonic scale, and many pipes were made in graduated sets of two or three instruments, presumably to be played in some polyphonic combination. Suggs' study of the scales produced by these panpipes led him to suggest that ancient Peruvian music at that time may have been more sophisticated in several ways than the contemporary music of Europe.

Slip casting in ancient Peru, then, had for its context the technology of musical instruments. It was the possibilities of the technique for precision manufacture that were exploited by the ancient Peruvians rather than those for mass production.

NOTES

¹ An earlier version of this paper was read at the 62nd Annual Meeting of the American Anthropological Association, San Francisco, November 21, 1963.

² A more extended account of the technique of slip casting may be found in Kenny, 1949, pp. 106-111.

³ Haggart, 1960, p. 104; Hughes, 1961, pp. 51-52.

⁴ Hughes, 1961, p. 51.

⁵ Brongniart, 1844, vol. 1, p. 149.

⁶ Suggs, ms.

BIBLIOGRAPHY

- Brongniart, Alexandre
1844 *Traité des arts céramiques ou des poteries, considérées dans leur histoire, leur pratique et leur théorie.* Béchot Jeune, Mathias (Augustin), Paris. 3 vols.
- Haggart, Reginald George
1960 *The concise encyclopedia of continental pottery and porcelain.* Hawthorn Books Inc., New York.
- Hughes, George Bernard
1961 *English and Scottish earthenware, 1660-1860.* Lutterworth Press, London.
- Kenny, John B.
1949 *The complete book of pottery making.* Greenburg: Publisher. New York.
- Suggs, William W.
ms. *The musical art of pre-conquest Peru.* Typescript, 14 pp., 1962.

KEY TO ILLUSTRATIONS

Plate X

Fig. 1. Broken panpipe, showing construction with separately made slip cast tubes. The greatest measurement across the broken surface is 5 cm. The specimen was collected by Max Uhle in 1904 from the surface of a site at San Nicolás, Supe. Robert H. Lowie Museum of Anthropology, Berkeley, no. 4-7408 o.

Fig. 2. Ocucaje style panpipes and an ocarina from Ica. The two panpipes on the right with tubes of uniform diameter are Ocucaje Phase 9; the two on the left with segments of different diameters are Phase 10. The largest specimen is about 25 cm. long. Paul Truel Collection, Ocucaje, Ica.

Fig. 3. Interior of a panpipe tube, showing untouched clay surface. The specimen is from Ocucaje, Ica, and is Ocucaje Phase 10; it is 5.8 cm. long. Robert H. Lowie Museum of Anthropology, Berkeley, no. 16-8933.

Fig. 4. Fragment of a pottery mold for making panpipe tubes from a site at Jahuay, north of Chincha, excavated by Edward P. Lanning in 1956. The associated pottery is terminal Early Horizon in date. Length, 7.2 cm. Field no. 101-1, S-II.

Fig. 5. Pottery musical instruments in the Nasca style; a straight trumpet, a whistle in the form of a bird, four panpipes, two drums. The specimens are probably all from Nasca. The trumpet in the upper left is Nasca Phase 4; the panpipe in the lower right belongs somewhere between Phase 1 and Phase 3. The rest of the objects are Nasca Phase 3. The panpipe in the lower left is about 28 cm. long. Museo Regional de Ica.

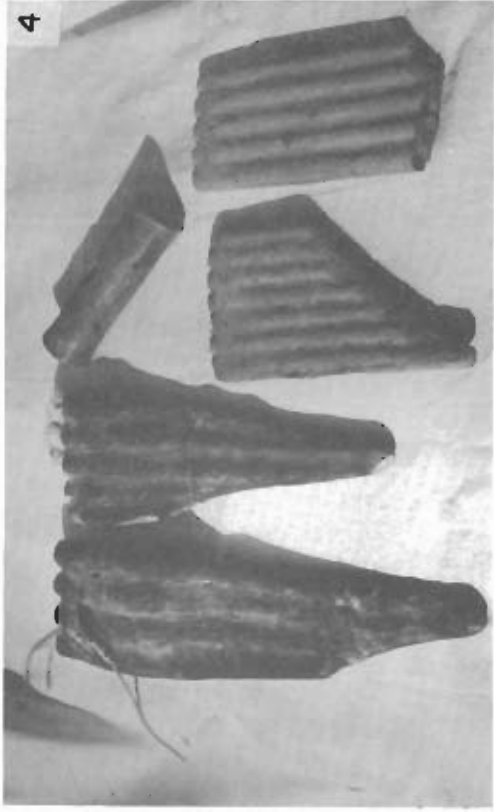
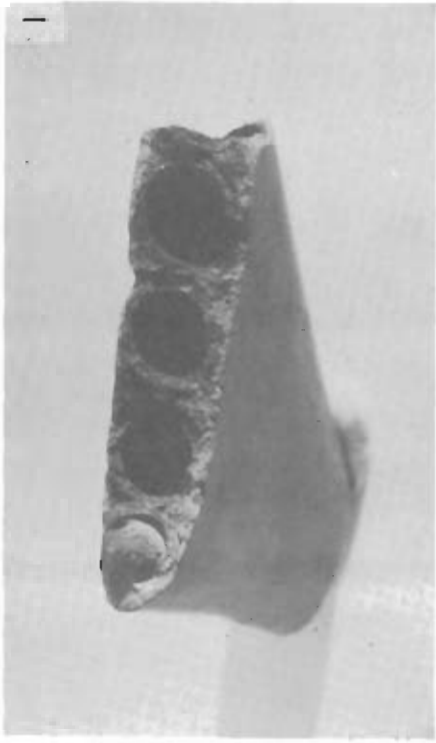


Plate X. (for details, see key to illustrations).