

PLANK CANOES OF SOUTH AND NORTH AMERICA*

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It has long been known that at two widely separated points on the Pacific shores of the New World there were aboriginal peoples who skillfully fashioned canoes made of thin wooden planks sewed together. These places were (1) the island of Chiloé off the southern coast of Chile, and (2) the Santa Barbara Channel region of the southern California coast.

Anthropologists have been interested in both of these occurrences because their respective origins are difficult to understand, and various authors have suggested their Oceanian origin. Cooper (1917:198-204) has clearly shown how the southward diffusion of the Chilean dalca was correlated with a progressive alteration in its form.¹ Such demonstrations are important control case histories and yardsticks in the general problem of diffusion. Studies of the Chilean dalca (Lothrop 1932:247, 249, 251) and Santa Barbara tomolo (Heizer 1938:220-222; 1941a:88; 1941:60-61) indicate, however, that in each case there are good reasons to believe in local development without the necessity of calling upon the hypothesis of Oceanic diffusion. It is the purpose of this article to summarize the technology of the Santa Barbara and Chilean sewn plank boats and the evidences which indicate that each boat had an independent local origin.

*This paper, in essentially its present form was written in 1942 and was to have been published by the Instituto de Antropología, Tucuman, Argentina. The first copy of the paper sent to Argentina never arrived, perhaps because the mail ship was sunk. A second copy was sent, but the paper was never published. I am pleased that the Kroeber Anthropological Society considers this early effort of mine (to which a few recent publications have been added) worth publishing.

THE DALCA OF CHILE

In the early historical period the dalca was restricted to the immediate region of the island of Chiloé. In later times it spread southward, this diffusion being recorded in the historical accounts. Coincident with the dalca's spread was the alteration in its form. The evidences are summarized below.

The earliest literary reference to the plank boat dates from 1557-58, in Miguel de Goicueta's account of the expedition of Cortes Hojea. Goicueta had accompanied Ulloa on an earlier voyage (1553) and probably saw these boats first at that time.² At this time (1557-58) the plank canoe was restricted to the area between the Gulf of Coronados (lat. 42° 30' S) and Cabo Tres Montes (lat. 47° S)³ and was made of three planks, as attested by Goicueta (1557), Marmolejo (1575), Brouwer (1643), Father Ovalle (1646), and Father Rosales (1674). Therefore, up to the end of the seventeenth century the Chilotan plank boat was of only three pieces. It was propelled by from eight to twelve rowers.

During the course of the eighteenth century, the dalca developed from a three-plank to a five-plank, and finally to a seven-plank boat. Father Olivares stated (1736) that the three-plank type was made, and that five-plank boats were also used. That the five-plank variety was the dominant one is shown by numerous statements to this effect in the historical accounts. Estimates as to the size of the boats in this period vary, according to Father Olivares they were from 45 to 65 feet long, but this figure either refers to a particularly large boat or represents an overestimate since the average of other observers is smaller.

Toward the close of the eighteenth century, seven-plank boats are mentioned for the first time by González de Agueros and Moraleda.

Byron (1764) and Vargas Ponce (1789) first mention the Magellanic presence of the plank boat, and in the ensuing century the boat spread

widely through the area of the Straits of Magellan.

The three-plank or primitive dalca had a long central board which formed the bottom and projected to give an overhanging bow and stern. The sides, cut to shape, were pierced with holes and sewn to the center plank. Planks were roughly split with wedges and worked down with stone axes and shell scrapers from the wood of the larch (Fitzroya patagonica), cypress (Libocedrus tetragona), or beech (Nothofagus betuloides). The fiber ordinarily used was prepared from bamboo (Chusquea coleu), but other materials were substituted if bamboo was not available. The joint between the two boards was covered with a roll of grass, the inner bark of the maqui tree (Aristotelia maqui) or the viscous leaves of the tiaca tree (Caldcluvia paniculata), over which the binding was wrapped. The joint was not entirely waterproof, however, and the boat made some water which was ejected with cylindrical bailers of bark or sealskin. There is no evidence that the primitive dalca was ever propelled with poles. A composite oar made of a flat blade lashed to a handle was used.

As the boat developed into the five-plank type, it increased in size and length. This increase was marked by the addition of a plank on each side to raise the freeboard. Sails were added. Finsterbusch emphasizes that the five-plank dalca, which he calls the transitional type, retained the essential technologic features of the original three-plank form.

The seven-plank type, representing the ultimate development of the dalca, bears many evidences of European influence.⁴ The southern tribes (Alacalufan) did not make the seven-plank boat, but continued the use of the transitional five-plank dalca.

The three-plank dalca was fitted with bottom runners used to drag it across portages. As Lothrop indicates, only small sized boats would have this feature since the larger vessels were dismantled when the Indians wished to transport the boat to other waters across a portage. Since the runners are known only from later times, it is possible that this is a

feature which developed in historic times. It is further likely that the practice of dismantling boats to transport them is also a development occurring in historic times since large and heavy boats are of post-Hispanic development. It is probable that the manufacture of large sized five- and seven-plank boats is a result of attempts to imitate European boats, and that their manufacture was aided by the introduction of European implements of metal, thus allowing larger planks to be split more easily than with aboriginal tools.

The final problem now remains for consideration. What are the evidences bearing on the questions of (1) the Chilotan dalca as possibly derived from a trans-Pacific Oceanian source, and (2) the dalca as due to local indigenous development.

R. B. Dixon, in an early effort to combat the theory of Graebner (1909) that the dalca was of Oceanic provenience, was not able to conclusively deny the possibility that the Fuegian boat could have been derived from the Pacific Islands (Dixon 1912:53-54). He pointed out that constructional similarities between Oceanian and Fuegian boats were absent, and concluded from this that genetic connection was unlikely.⁵ The theory that the dalca is of Oceanic provenience must be considered as unproven and improbable in the absence of supporting evidence.

Turning to the local development hypothesis, we find numerous indications that the dalca is an indigenous product of the restricted area where it was first noted by early observers. Cooper (1917:201) points out that the plank boat is not to be considered as of Peruvian origin since this boat was never known on the Peruvian coast. The dalca cannot be of European innovation since it was found as early as 1558 in the Coronados Gulf region, and was seen as far south as the Taitao Peninsula five years earlier. At this time the Fuegians were not using the dalca; they acquired it later from the Chonos to the north.

Cooper (op. cit. 201:202), denying evidence of Oceanic introduction,

finally resolves the question of local origin into the problem of whether the Chonos or southern Araucanians first invented the plank built dalca.

He says:

Geographical conditions were as favorable for the advancement of boat building among the southernmost Araucanians of Coronados Gulf and the Chilotan Islands as among the Chonos, both people being archipelagic and seafaring. Cultural conditions, however, were much more favorable among the former, who were on a decidedly higher cultural plane, and in addition were familiar with the arts of axe making and plank cutting, arts which would easily lead up to the use of wood in boat building.

The axe was of sporadic occurrence only among the Chonos . . . , but polished stone axes were common among the southern Araucanians. . . .

The plank-making industry of the Araucanians was no doubt pushed forward by the Spaniards after the introduction of metal axes, but the use of planks in hut building among the southern Araucanians pretty clearly antedates the Spanish conquest. It is not surprising, therefore, that these archipelagic seafaring Araucanians should have introduced the use of planks into their arts of boat building.

It may be recalled, too, that plank boats were found in abundance by Cortes Hojea among the Coronados Gulf Araucanians, and are merely mentioned as being in use among the Chonos, and that the general cultural migratory drift in this territory was from north to south; that is, from the Araucanians to the Chonos, not vice-versa.

For the foregoing reasons, it appears much more probable, although not strictly demonstrated, that the Fuegian plank boat originated among the southernmost Araucanians, from whom it passed successively to the Chonos before 1553 or 1558, to the natives south of Taitao Peninsula later, and to the middle of the eighteenth century.

Cooper (1917:202-203) and Lothrop (1932:249, 251) both agree that the plank boat probably came into being through the substitution of split planks (among the Araucanians) for thick beach bark slabs (a Chonoan feature) for making canoes. Friederici (1907:43) maintains this view as the probable course of the development of the dalca, while Graebner (1909:1018) holds the opposite viewpoint, maintaining that the Fuegian bark canoe is derived from the plank boat and can therefore hardly be its ancestor.⁶

As to the time the dalca was developed in the Chilotan region, Lothrop (1932:250, 251) shows with admirable clarity that population shifts involving the Cunco (see note 3) and Chono caused these two groups to meet on the island of Chiloé in the fifteenth century A.D., at which time the development of the plank-built dalca probably occurred. This date is supported in part by Lothrop's archaeological excavations, and by the fact that in the middle of the sixteenth century the dalca had a restricted distribution which is, in view of its later spread, presumptive evidence of its relatively recent origin.

THE TOMOLO OF THE CALIFORNIA COAST⁷

The tomolo has a history and development which is a partial repetition of that of the Chilotan dalca. There are several reasons for this, among which may be mentioned the facts that the tomolo was structurally

unsuited to continued use in unprotected waters and therefore underwent only selective, local diffusion; and that the Chumash Indians, who were the master canoe-makers of the southern California coast, were rapidly Hispanicized in missionary establishments and soon relinquished their native ways in favor of those of Europeans.

The earliest reference to the tomolo of the Santa Barbara Channel region is to be found in the account of Cabrillo's expedition in 1542. Various historical accounts over the period from 1602 to 1793 (Cermeño 1595; Vizcaíno, Torquemada 1602, Portolá, Fages, Crespi, Costansó 1769-70; Ortega 1770; Crespi 1774; Font 1776; Menzies, Vancouver 1793) yield collectively enough information to enable us to reconstruct with fair accuracy the form and construction techniques of the tomolo.

The plank boat of the California coast was composed of many small, thin planks--Font, in 1776, counted one made of twenty pieces. The planks were fashioned from driftwood logs with whalebone splitting-wedges. The woods reported to have been used include cedar, pine, and redwood. A heavy bottom plank measuring 1.5 inches thick, 12-14 feet long, and 8-10 inches wide, with holes drilled along the edges, formed the base, and to this were bound the heavy bow and stern posts, which took off at an angle of about 30 degrees. To each side of the baseboard were attached the small side planks, at an angle of about 50-60 degrees. Each plank was bound firmly on all four sides to adjoining planks. The lowest course of planks was tied with fiber or sinew cords through drilled holes to the heavy bottom board, and in the same manner at each end to the bow and stern posts. As each plank was tied in place, a thick layer of hot, viscous bitumen was applied on the four edges.⁸ This bitumen layer acted as calking material,⁹ so necessary in this boat which might have in excess of a hundred separate joints. After the boat was completed, a layer of hot asphaltum was spread over the joint surfaces as further insurance against leaks. It was then painted with geometric designs of red or white, and

inlaid with marine shells. Notwithstanding the large number of European explorers who saw and noted these canoes, none seems to have made a pictorial record of them. Archaeological evidence of the Chumash canoe is limited to some probable planks. Its actual form is therefore somewhat conjectural.

No ribs, frames, or internal strengthening were used in the construction of the tomolo. This fact is attested by numerous observers. A single center thwart laid across the gunwales and tied at each end was sufficient to preserve the convexity of the frame. As has already been pointed out (Heizer 1940a:84), these canoes were based on the principle of flexibility. The weight of the paddlers who crouched or knelt in the bottom of the boat would tend to draw the gunwales together and thus tighten the sewn seams.

Although the tomolo was of a good size (Portolá says 24 feet in length; Costansó, 24-30 feet; Crespi, 21-24 feet; Font, 24-26 feet; Menzies, 12-18 feet), no observer ever saw one bearing more than three or four men, yet estimates of their potential capacity run from eight to ten men, or even more. Thus the European observers were misled as to the actual strength of the canoes by their size.

The tomolo was narrow (measurements are invariably given as 3 to 4 feet) and could therefore be propelled by double-blade paddles which were from 6 to 10 feet long.¹⁰ The paddle blades were mortised and bound to each end of the long shaft. Single-blade paddles were never used, nor were oars. Bailers, probably of wood or shell, were used to dip out the water entering the boat through its many joints.

An unusual feature of the Chumash canoe is the elevated planking in the bow and stern which drops off at the center and leaves the gunwales lower than the ends. This may be a feature which was evolved locally to enable the boat to come through the surf without shipping water over the end from a following wave. Stone models of canoes from archaeological

sites in the Santa Barbara Channel region show this feature of the elevated bow and stern. The tomolo was a double-ended affair which could be propelled in either direction.

The tomolo was restricted to the Santa Barbara Channel region between Point Conception (lat. 34° 50' N; long. 121° 50' W) and Point Mugu (lat. 34° N; long. 119° 15' W) to the southeast, including the offshore islands (Santa Barbara, Santa Rosa, San Miguel). This is the territory occupied by the Chumash Indians, and is notable in comprising a narrow coastal strip with a mountainous hinterland. The coastal waters are relatively calm and quiet as a result of the protection afforded by the off-lying islands. Here the slight tomolo could be operated safely. The coast to the north is rocky and unprotected, and the tomolo was not used by the inhabitants, who were also Chumash. In 1776, it was noted by Font that six Christian Indians from San Luis Obispo Mission were escorted south to the channel where they bought two Chumash plank boats and returned with them by sea.¹¹ Here, near Obispo, Vancouver saw plank boats in 1793. This seems to be the only evidence of historic spread of the tomolo, and supports the conclusion that "in aboriginal times the Chumash of the Santa Barbara Channel region alone made and used the plank canoe" (Heizer 1941:60).¹² Because it was primarily suited to the sheltered channel, the tomolo was not structurally adapted to use on the rougher open coasts to the north or south, with the exception of sheltered bays (e.g. Obispo) where it was adopted in post-Spanish times. Elsewhere tule balsas, or occasionally dugouts, were used (Heizer 1940a; Heizer and Massey 1953).

Two alternative problems concerning the origin of the tomolo must be considered. These are the same problems as those surrounding the dalca; i.e. is the Californian tomolo ascribable in origin to Oceanic influence, or is it a local product developed independently of external stimulus?

DISCUSSION

Lothrop (1932) argued that the early restricted distribution of the Chilotan dalca was an indication of its relative recency in the area. This is supported by the observation that the dalca subsequently diffused far to the south. The argument, while probably true, must be tempered by the alternative one that European contacts may have stimulated native movements which, incidentally, served the purpose of initiating other tribes in the art of plank canoe making, and that, in part at least, the diffused dalca was the modified five- and seven-plank type which might also be ascribable, to some degree, to European influence. In short, had not European contact been effected with the Fuegians and Aracanians, the dalca might not have diffused so widely, nor have evolved into a seven-plank type through the intermediate five-plank form. The dalca, made with internal ribs, was a fairly sturdy craft, fitted for rough waters.

The Chumash tomolo was originally restricted to the channel region; it spread northward due to the instigation of the mission padres at San Luis Obispo. In pre-Spanish times, the tomolo had not diffused more widely because, presumably, its constructional strength was so slight that it was unsafe to use in rough waters. It is also possible that the technological abilities of the Chumash living north of Point Concepcion were not sufficient to manufacture and maintain such craft in repair. Asphaltum is absent north of the Point, and the Spanish explorers make it quite clear that they considered the northern coast Chumash much less advanced than the Channel people. Balsas were used elsewhere,¹³ and, although not as useful as a plank canoe, they were more dependable. The criterion of limited distribution as an indication of recent development, therefore, does not hold in the case of the Santa Barbara tomolo, nor can it be unquestionably admitted in regard to the Chilotan dalca.

The tomolo seems to have been present in the Santa Barbara Channel

area only relatively recently, since remains of the boat are limited to archaeological levels ascribable to the ancestors of the ethnographic Chumash Indians.¹⁴ Since the tomolo was abundantly present in 1542 when the first Spanish explorers visited the Chumash, there is no possibility of its origin in historic times. Presumably the development of the Chumash plank canoe dates from some time prior to the sixteenth century--perhaps several hundred years is a fair guess, since the Late Mainland culture sites might not be older than 500-600 A.D.¹⁵ It seems safe to assume that the tomolo was in existence by 1000 A.D.

Friederici (1907:67), basing his conclusion on insufficient evidence as I indicated elsewhere (Heizer 1938:213), associated the Chumash and their plank canoe with the tribes of the Northwest Coast. This theory has no evidence to support it. Wooden canoes, whether dugouts or plank built, were unknown along the whole coastal stretch between Point Concepcion and Cape Mendocino.

MacLeod (1929:557), in answer to Dixon, argued for an Oceanic provenience of the Chumash tomolo. Dixon (1928:193-197), Lothrop (1932:244-251), and Cooper (1917:198-204) all agree as to the lack of evidence indicating Oceanic affiliation of both the dalca and tomolo. They have all cited as the type of canoe made and used by the Chumash the description in the Wheeler Survey report which describes a boat made of three planks (Yarrow 1879:44; 1881:112). All other information, and it is abundant, proves that the canoe was not made of three planks but of a great number of small ones. The canoe described by Yarrow may have been incomplete,¹⁶ it may represent a late canoe made of large planks split or sawed with superior metal tools introduced by the Spanish, or, a third alternative (and the best in my opinion), is that what Yarrow took for a canoe was nothing more than a wooden coffin. In the grave with this wooden piece were found metal objects which prove that the burial dated from post-Spanish times.

Presumptive, indirect indications all point to the conclusion that the Chumash tomolo is a local product. Solid evidence of Oceanic contacts with the Chumash are lacking, and we must therefore accept the more likely hypothesis of a local origin.¹⁷

Obviously, the plank boat must occur in a plank-making and plank-using culture medium. The Santa Barbara Chumash meet the requirements in this regard since they split planks from stranded pine, cedar, and redwood with bone wedges, and used these planks for many purposes; e.g. grave-markers and rectangular boxes. I have concluded elsewhere (Heizer 1938: 220-221):

That the plank canoe originated along the Santa Barbara Channel is indicated by the following observations: this coastal strip was one of protected waters with an abounding marine life. The seacoast life, with an arid interior offering little inducement for travel, hunting, etc., naturally presumed a subsistence dependent, at least in great part, on fishing. The technological achievement of Chumash culture was very high indeed--much more than that of any of the neighboring peoples. . . . The easily obtained quantities of asphaltum from surface springs led to its utilization in many ways. That it would be ideal for the canoe is an obvious point. Indeed, it is hard to conceive of this multi-plank canoe with its numerous drilled lashing holes and small planks without great quantities of asphaltum as a calking material. The manufacture of wooden boxes made of small split boards drilled, bound, and asphalted is known archaeologically. Broken steatite vessels were repaired [by crack-sewing] in the same way. The historical accounts bear frequent mention of split plank

grave-markers with painted designs. Even the steatite canoe models, unique to Santa Barbara archaeological sites, would seem to indicate that their counterpart in form, the wooden canoe, was typically a Channel product. All these elements are "at home" in Chumash culture. They are also integral parts of the plank canoe complex.

Elsewhere I have reviewed this same question and reached a similar conclusion (Heizer 1940a). There seems to be no logical prototype from which the tomolo was derived; it looks like a synthetic invention rather than a direct copy or imitation of an antecedent boat.

We may conclude with the summary statement that the Chilotan dalca and the Santa Barbara tomolo, in the light of present information, are each ascribable to local and independent origin. There is no evidence that either type has any Oceanic affiliation, nor that they are connected with each other.

NOTES

1. Cf. also Finsterbusch 1934; Lothrop 1932; Latcham 1930.
2. Cf. Cooper 1917:198. The data cited here are taken from Cooper (1917:198 ff.) and Lothrop (1932:244 ff.). Cf. Edwards 1965:25-34.
3. The area occupied by the Cunco (a subgroup of the Huilliche Araucanians), Chilote, and Chono Indians.
4. Lothrop (1932:246-247, pl. XXI) describes and figures in detail the seven-plank dalca. Edwards (1965:27) considers the five-plank dalca and the use of oars as "certainly manifestations of European influence."
5. Dixon 1928:193-197. Cf. Lothrop 1932:247, 249; Cooper 1917:203-204; Edwards 1965:90-92.
6. Cf. also Edwards 1965:91.

7. Data concerning the Californian tomolo are from Heizer 1938; 1940a; 1941. See also Heizer and Massey 1953; Durham 1960:88-92; Robinson 1942-43.
8. Asphaltum springs are very common in the Santa Barbara Channel region (Heizer 1940).
9. The San Diego canoe, made in 1914, is calked with asphaltum and tule stalks, So far as is known, this last feature was not employed aboriginally.
10. For further data on the use of double-blade paddles see Kroeber 1931:20-21; Heizer 1938:218-220; Heizer and Massey 1953:303-308.
11. Wagner (1924:6) refers to Fages (Suplemento de Noticias del Estada que guardan las Misiones de Monterey y California, 1775) who mentions plank canoes used at San Luis Obispo.
12. Cermeño, in 1595, recorded only tule balsas at San Luis Obispo Bay (Wagner 1924:1516).
13. For distribution see Heizer 1940a:map. To this may be added Cermeño's account of 1595 (Wagner 1924:13, 15-16) wherein is mentioned the tule balsa and double-blade paddle at Drake's Bay and the balsa in San Luis Obispo Bay. The double-blade paddle and balsa are recorded by Colnett (1940:175-176) from Bodega Bay.
14. The Late Mainland period of Olson (1930) and the Canaliño culture of Rogers (1929).
15. This date is an estimate derived from trade objects (pottery and grooved stone axes) in the Pueblo and Santa Barbara Channel areas.
16. Rogers (1929:311) notes that only canoe fragments were found in burials.
17. A recent argument holds that the Chumash canoe may have derived from India via Oceania (Durham 1960:95). The C-shaped shell fishhooks of the Chumash constitute another possible element of Oceanian origin (Heizer 1949; Landberg 1966). However, because this type of hook is

so widely spread along the Pacific shores of the New World (e.g. Peru, Ecuador, Chile, California) and through the Pacific Basin (Anell 1955), it seems unlikely that all the occurrences are ascribable to derivation from one source. The problem of the C-shaped shell fishhook will no doubt remain a subject of inquiry for some time to come.

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