Traditional Gujarat Boat Carpentry - Intriguing Departures
The Case of the *Batelo* of South Gujarat
by
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This presentation will be confined to the study of methods of boat construction and plank joinery as documented on the basis of oral explanations provided Lallubhai Ramabhai Patel, Contractor on the work procedures documented at his boat building yard located in Village Ponsri, Taluk Gamdevi, District Navsari, South Gujarat. The boat models under construction in his yard were modernised and mechanised versions of earlier types but work procedures have continued unchanged. There is an immediate resonance with the documentation recorded at Surat by the Dutch traveller, John Splinter Stavorinus circa eighth decade of the eighteenth century as well as James Hornell who covered the techniques of plank joinery circa 1946 in Bulsar and Bilimora. In the case of Hornell the material collated from Dayabhai Tandel of Village Moti Danti, District Valsad, South Gujarat in relation to the construction procedures followed in the sailing vessel, the South Gujarat *batelo*, forms a useful point of reference on the validity of Indian ethnographic sources. However, it is important to remember that whereas oral information remains virtually uninterrupted in the case of wooden crafts, resulting from the introduction of fibre glass old tools and work procedures are being rapidly replaced by mechanised tools with accompanying discontinuities in work procedure.

Another aspect which has to be borne in mind the traditional approach to work procedures throughout artisanal India enjoys a basic commonality. Memory, manual skill, work experience and that indefinable quality of true apprenticeship with the master prevail over modern approaches to education. Rough and ready tools abort the need of standardised contrivances. These are difficult to verbalise but field exposure to prevailing procedures, in this case, boat building, whether it be in Gujarat at the western tip of the subcontinent or in West Bengal towards the eastern end reveal similar solutions to problem solving. Just as Gujarat appears to have succumbed to a western model and successfully absorbed it within its traditional approach in West Bengal there is an analogous example in more modern times. This is found today in the construction of the *Kakdwip trawler* in Kakdwip, South Twenty Four Parganas, West Bengal[1].

In Gujarat the problematic is whether it is the Portuguese or the Dutch method which played the lead role[2]. In this context Ernestine Carreira[3] clearly establishes that as early as 1580 European methods of ship carpentry were consciously fostered by the Portuguese in Daman. The Dutch influence is associated with Kutch [4] . The maritime development of Kutch is chronologically analogous to that of South Gujarat. However, there is a disjunction in dating between the creation of port and constructions of boats building facilities at Kutch Mandvi and explicit connectivity with the Dutch. It is stated that a merchant, Topan Seth, circa 1581 developed port installations and ship building facilities here. He also set up furnaces in neighbouring Bhachau for the manufacture of nails. However, it was only in 1732 that there is reference to the navigator, Ramji Malam, who is said to have made his way to Holland. Ramji Malam is reputed to have spent eighteen years in Europe where he learned several technologies which he introduced on his return to Kutch.[5]

At the initial stage the two stem and stern posts are joined to the keel after which the two garboard planks are rabbet jointed to the keel. The ribs are raised on this base thus providing a skeleton structure on which the remaining portion of the hull is to be raised. The floor timber is joined with nut and bolt to the ribs by the joint known as the *phasri wad* without any luting procedure. As there is a minimal support base, the series of floor timbers and ribs are supported and held in place by temporary horizontal wooden planks. While the method of the support system approximates that of skeleton first in boat construction the cognitive approach to boat building particularly as relating to points of curvature are based in practices associated with shell first techniques as have been documented in other parts of coastal India.

The basic question remains – why does Gujarat plank joinery take recourse to iron nails along with nuts and bolts and why is the shaping of the hull based on the system of the prior elevation of ribs? The author will base her presentation on field generated ethnological data tracing the elevation of the hull from the stage of laying of the keel to the finishing of the hull. Perhaps the presentation of this material to an international audience will elicit some answers.

We now turn to the description of the construction at Surat of a 100' long keeled boat provided by the Dutch traveler, John Splinter Stavorinus in the 18th century:

> "Most of the timbers are fitted in after the planks have been put together …They do not put the planks together as we do, with flat edges towards each other, but rabbet them; they make the parts fit each other with the greatest exactness… for this purpose they smear the edges of the planks which are set up with red lead, and those which are intended to be placed next, are put upon them, and pressed down, in order to be able to discern the inequalities which are marked by red lead … they repeat this till the whole fits exactly; they then rub both edges with a sort of glue which becomes, with age, as hard as iron, and they cover it with a thin layer of kapok, after which they fit (and) unite the planks so firmly and closely with pegs, that the seam is scarcely visible and the whole seems to form one entire piece of timber.
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> They fit the timbers and beams in the same way to the planks; so that a piece of wood is sometimes put in and taken out more than ten times before it is fixed for good and all.
>
> Instead of bolts, they make use of pieces of iron forged like spikes, the point of which is driven through, clenched on the inside, and again driven into the wood. They make the iron which they employ for this purpose tough and flexible."

The description given by Hornell (Hornell, 1946, 205) with regard to the building of the Gujarat *machwa* at Bulsar and Billimora provides additional details:

> "In all Arab-style craft the planking is laid edge to edge, thereafter rendered watertight by caulking from the outside; in the purely Indian method as followed in Gujarati boat-building the edges of the planks are grooved in a peculiar zigzag manner which enables them to key together securely; in the grooves are laid strands of cotton and a layer of putty made by boiling together a mixture of dammar and oil, subsequently hammered into a paste-like mass. The planks are then drawn together tightly by lashings passed through holes bored in adjoining strakes, then tautened by forcing wedges between the lashing and the planks. When drawn sufficiently tight, long iron nails are driven through the planks and through the ribs, the projecting inner ends beaten down finally to serve as clamps. This method of construction renders the repair of damaged strakes a matter of difficulty but these Gujarati boat builders look down with contempt on what they consider the crudeness of the plain edge-to edge plank fitting of Arab style vessels".

Hornell provides another detailed description of the rabbet joint used in vertical joinery to increase the span of the planks placed in a row to form the horizontal segment of the hull:

> "…each edge of the plank, a full inch in thickness, even for the smallest boat, is cut into two sharp-edged triangular tongues one much larger than the other, giving a complete V-shaped groove between and one beveled margin, the half of a groove on the one side. The relative positions of the

> grooves and tongues in the upper edge of the plank are reversed on the lower edge in order that the edges of adjoining planks may interlock when finally brought together. The cutting of the grooves is done by means of a small and relatively very heavy adze of peculiar shape, differing from the ordinary European tool in having practically no curvature of the blade which is 5 inches in length, 2¾ inches in width at the cutting edge, and with a weight of 3 lb.
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> The adzing of the grooves is done very rapidly and skilfully, guided entirely by the eye and without any preliminary marking upon the edge. When roughed out, each plank is fitted permanently into position and spiked down, the upper edge of the next lower strake is smeared with a water solution of red ochre, here called *Hormuzji geru*, … this is applied by means of a frayed-out brush-end of coconut husk. When this coating is quite dry (its application is said to help the dammar to adhere better), a coat of dammar boiled in sweet oil (usually *til*) is thickly applied to the ochre-painted surface. Over this before it dries is spread a caulking layer of soft cotton as taken from the seeds. The next strake is then fitted into position and hammered to fit tightly against the lower, no ochre or dammar being applied to the lower edge of the superior plank. To hold the strakes together in further security, black iron spikes are driven obliquely from the inner side of the upper plank, through the joined tongues and grooves, the head of each nail being counter sunk. Only when these operations have been completed are the planks spiked to the frames. The ends of the planks where they butt against the ends of others are grooved and treated similarly to the longitudinal edges…

These details suggest that the type of boat joinery used in Gujarati boat building offers a variation from the pattern of sewing found in Lakshadweep[6]. Ethnological evidence which will now be offered will make these details easier to grasp. The visuals have been drawn from boat building practices documented in the field[7].

This article will be based on oral information drawn from local informants as well as documentation based on ethnological practices of boat building prevalent in South Gujarat (Ponsri,Taluk Gamdevi, District Navsari). While Gujarat boat typology has been greatly hybridized in present times carpentry practices can still be linked to earlier usages as a comparison between field generated evidence with the data provided by Stavorinus and Hornell would demonstrate. This continuity in technical details in ethological practices in Gujarat has been favoured by historical circumstances. The boat building procedures recorded in this paper are based on data drawn from yards located in South Gujarat[8].

Documentation of the South Gujarat *Hodi*

According to oral tradition[9] the traditional boat of South Gujarat was the *vahan* or the Surati *batelo* (fig. 1). The oral information relating to this model will be integrated with the documentation of actual carpentry processes witnessed at the Lassubhai Ramanbhai Patel, Boat Building Yard, Village Ponsri, Taluk Gamdevi, District Navsari. The boat documented here was a *hodī* of earlier times, now modified to function as a trawler. However, both the carpentry as well as the joinery procedures has endured into modern times with little modification. The processes of boat building have been meticulously described in the sources quoted above and will not be duplicated. However, additional ethnological data is being provided below.

The maximum and minimum lengths of the keel of the *batela* range between 100' and 60'. The *pathan,* keel, would be aligned on a series of *vahan cha*, supports, 3' in height and 10" in width. Single supports are placed to preserve balance while double props, nut and screw bolted, are placed on either side to prevent shift (fig. 2). The *vahan cha* are positioned at intervals on the ground, the longest keel requiring six and the smallest four. Additional rests would be positioned as the building of the hull progresses upward (fig. 3). The wood from which the *phalli/ lang,* planks, and other boat structures are to be sawn are, to the extent possible, secured from naturally curved logs (fig 4) to avert points of weakness. The two *agli nar* and *pichli nar* (stem and stern posts) are joined to the *pathan* (keel), the order followed being firstly the stem and followed by the stern post. These are held in place with the help of external supports. The angle at which the two posts are to be joined to the keel is not determined by any measurements taken inboard. It is defined by the unit of distance between two points. The first point is located outboard at the place of juncture between the post and the keel. The second point is set at the intersection between an extended line drawn from the first point and the place at which the this line intersects with a position marked by a vertical line extending down from the upper terminal end of the post. The greater the distance the larger will be the angle at the point of junction between the post and the keel indicated by the first point.

The length of the keel is now divided into five segments, each point being called *joroo* or *farma*. The distance on the keel between the individual *farma* is called *gala*. At each *farma* a continuous angular frame stretching from the keel upwards would be placed (cf. fig. 5). Proceeding from stem to stern, the first *farma* would encompass a width of 13' at the top, the second and third would comprise a width of 17' while the last towards the stern would stand at

15'. Each frame would be attached to the keel by nut and bolt. The master builder would then assess by eye, *nazar*, whether any adjustments were required. The frames would be continuously refashioned until the master carpenter was satisfied. The term for floor timber is *dariya vāk* the rib being called *bras vāk*. A temporary wooden plank would support each point of extremity of the *bras* the upper extremity of each frame to hold the structure in position (fig. 5). During this exercise the master carpenter would have also encompassed the desired curvature of the bilge. The two *makkhi pathan* (garboard) are *vadhro* (rabbet) jointed to the *pathan* thus completing the skeleton structure (Fig. 5). At this juncture the two keelson, *pathanu*, extending between the two terminal ends of the keel to the second and fourth *farma* (Fig. 6), respectively are secured into on the *vāk* with a bent nail, *dagri keel* in alignment with the keel[10].Water accumulates at the area between the two points of termination of the *pathanu*. Limber holes, *hamare*, are provided in the floor timbers, the *dariya vāk* (fig. 7).

The remaining portion of the hull is to be completed. The floor timber is joined with nut and bolt to the ribs by the *phasri wad* (fig. 8) without the luting procedure. As there is a minimal support base, the series of *vāk*, floor timbers and ribs are held in place by temporary wooden planks (fig. 5). After the hull has been completed an outer protection cover for the stem post, *par nar* made to adhere without any jointing procedure with *mir* (fig. 9).

The iron adze referred to by Hornell is the *vāla* (fig.10) while the chisel is called *pharsi* (see fig. 11). The term for fender (see fig.7) is *lobadi* and that for the stringer (corresponding to the fender but aligned above the *vāk* along the upper section of the inner hull) is *tāl*. A third element, the *perchā*, is laid above the gunwale, to facilitate walking (fig. 13). The generic term for plank joinery is *data*.

To secure bending where required the planks are coated with mud on both surfaces and placed above a fire created of wood shavings being turned over from face to face several times (fig. 14). Water is sprinkled to control the heat during this procedure. The head carpenter, *vadhiva*, supervises this process. While the plank is still hot it is carried to the hull and clamped into position to acquire the desired curvature. The wooden clamp secured to the *phalli*, plank with rope is called *potha* (fig.15). After between two to three hours the *phalli* is taken off,

secured into position on the ground and left to cool for between 12 to 24 hours (fig.16). It is then reset on the hull.

The carpentry procedures followed in the construction of the *hodi* documented at Ponsri demonstrated a remarkable ethnological contiguity with the earlier descriptions of Hornell and Stavorinus recorded above. Although a single plank would be preferred for the keel, and indeed, the *hodi* documented at Ponsri had a keel, 44' in length secured from a single piece of wood, longer keels demanded joinery to achieve the desired length. The scarf (fig. 17) or keyed scarf, the generic appellation being *sandho*, is used (fig. 18). The *pathanu*, keelson, is fixed into position on the *vā k* with a bent nail, *dagri keel* in alignment with the keel.

The points of termination of the *aga nar* and *pichli nar* at which they are joined to the *pathan* are of the same dimensions as the mating face of the *pathan*. Both edges are cut at right angles so that one slips into the other, the joint being called *pathan nar jorwano* (see fig.12). A variation of the same joint is used in lengthening the floor timbers and ribs, the *vāk* (cf. fig. 8). When the *vāk* are lengthened upward nuts and bolts are used at the point of joinery. The *vāk* are nailed in from outboard being clenched inboard. The wood below the head of the nail at points of curvature is etched out in triangular shape and the head of the nail is recessed into this (fig. 19).

The major joint used both for laying the individual rows of hull planking on the vertical plane as well as in extending individual planks of the hull on the horizontal plane is the rabbet, the *vadro khacho*, so graphically described above by Stavorinus and Hornell. The joinery between the individual rows of hull planking and the stem and stern posts is also by means of the *vadro khacho*. The process of defining the angle which will shape the rabbet is shown in figures 20 and 21. Since the hull also has a rounded form along its bilge the plank has to be shaped accordingly and the angularity of the rabbet joint has to incorporate this requirement (cf. fig.22). Proper fitting of planks at such points of curvature involves greater care than in portions without angularity. A series of marks are made in chalk to indicate how much paring is to be done at various points to ensure smooth accommodation between the two rabbet edged planks (figs. 23**,** 24, 25, 26, 27). Figure 28 shows the angularity towards the stem section while figure 29 show a more flattened form towards the stern. Indications of specific areas along plank widths which are to be chiselled are drawn with *dori*, string, and *kharu*, chalk The mating edge of the plank,

rabbeted and fitted on the hull, is painted with a mineral colour, *gheru*, and the about to be fitted plank is then set on a trial basis several times (Fig. 30). At each fitting the areas where the *gheru* has been transferred are planed until a perfect match is obtained. This process of repeated fitting is called *vadro de nir*. The method of luting described by John Splinter Stavorinus continues into present times, gum being called *mir* while the appellation for cotton wool is *kapas*. The proportions used in Gujarat for making *mir* are 3 kg of damar[11] to 2 kg of *til* , sesame oil.

Lap joints are also in evidence at the bilge (figs. 31 32). Apart from bending through heating of the wood clamping also plays a crucial role in ensuring spot adjustments. In certain spots the clamps have to be nailed or screwed into position. After the clamping procedure these holes are plugged from the outer skin with *sura*, wooden pegs (fig. 33). If clamping is to be accomplished over wider horizontal areas the metal clamp, *bhir*, is used (fig.29). The lashing device to draw together individual rows in hull planking mentioned by Hornell in relation to the construction of the *machwa* at Bulsar and Billimora appears to have been totally replaced by systems of clamping in modern times.

On completion of the hull mast steps, superstructures and masts are prepared. After all building procedures have been completed there is meticulous segment by segment inspection of the hull (fig.34) with markings to show satisfactory conclusion. A solution comprising equal proportions of dammar and groundnut oil is made and applied with a *pissi*, cotton wool twisted around a handle, both on the inner and outer skins of the hull. It is then left to dry in the sun. It is now ready for commissioning.

Conclusion

In conclusion it may be stated that there is a huge repertoire of ethnological data waiting to be explored and documented in Gujarat. The richness of the data points to the fecundity of the maritime contacts of Gujarat in earlier times. It is also important to note that methods of boat building in Gujarat are quite distinct from the rest of the surrounding area in which the sewn plank tradition as reviewed by Patrice Pomey [12] is the prevalent mode. This also raises the interesting question as to whether a similar pattern existed in other pockets of West Asia. In the light of the prevailing data base available to the authors of this article the answer remains elusive.

[1] See Varadarajan, forthcoming, Chapter 9, "The *Kakdwip trawler".*

[2] See Unger, 2011. The significance of the Portuguese inputs into the Dutch maritime practices is stressed in this article.

[3] Ernestine Carreira, 2006, *op.cit*, 595. Carreira further states (*ibid*., *loc.cit*.) that only small to medium ships suitable for sailing in the western Indian Ocean were built at Daman. In 1580 a master ship builder from Venice was hired to introduce European techniques and models into Daman.

[4] For Dutch shipbuilding see Hoving, 2012, 8.

[5] See Makrand Mehta, 2009, 55-56.

[6] See Lotika Varadarajan, *Sewn Boats of Lakshadweep*, National Institute of Oceanography, Panaji, Goa, 1998.For a rich array of comparative literature see Sean McGrail, Eric Kentley, *Sewn Plank Boats*, National Maritime Museum, Greenwich, Archaelolgical Series No. 10, BAR International Series 276, 1985.

[7] Cf. Manubhai B. Pandhi who refers to tools and aids used by Kutchi mariners. Pandhi, 1976-1977, pp.141-174.

[8] The richest areas of traditional boat building practices in South Gujarat are to be located around Bilimora and Navsari. Bilimora was earlier located in the Gaekwad possession known as the Navsari Prant (district). In present times these locations are to be found in District Valsad. Bulsar or Valsad was a part of Bombay Presidency, British India. Acknowledgement: Hasmukh. Shah, Vadodara.

[9] The informants include: Dayabhai Tandel, Village Moti Danti, Dist Valsad and Laljibhai M. Tandel, Village Nani Danti, Dist Valsad, interviewed on 05 Oct 2010, and again on 23 Aug 2012; Lallubhai Ramabhai Patel, Contractor, Boat Building Yard village Ponsri,taluk Gamdevi, District Navsari, interviewed 11 March 2011 again on 23 Aug 2012; Bhai Jagdish Dwarkanath Koli (Trombay, Mumbai),overseeing the building of the *hodi*-trawler commissioned by him at the boat building yard of Lallubhai Ramabhai Patel, interviewed at Ponsri 11 March 2011.

[10] According to Dayabhai Tandel, Village Moti Danti, Dist interviewed on 23 Aug 2012 the nail is first bent and then straightened. After hammering in a vertical fashion at the desired point it is driven in an angular fashion and it then resumes a bent form.

[11] Dammar used in Gujarat can be secured from various sources : Andaman damar (*Canarium euphyllum*), black damar (*Canarium strictum*), rock damar (*Hopea robusta*), white damar (*Vateria indica*) <Major Research Findings - Central Institute of Fisheries Technology, http://www.cift.res.in/innercontent.php?contentid=NzM=&mater...>

[12] Patrice Pomey, pp. 133-146 in Varadarajan, 2011.