

A closer look at Egyptian boat construction and design: the Khufu barge



Khufu, 4th Dynasty: ca. 2470-2447 BCE
his pyramid and his barge, discovered
disassembled



Like the pyramid, Khufu would have commissioned the construction of the barge during his lifetime; it is a funerary barge, though whether it was actually used (and then disassembled) is archaeologically unclear



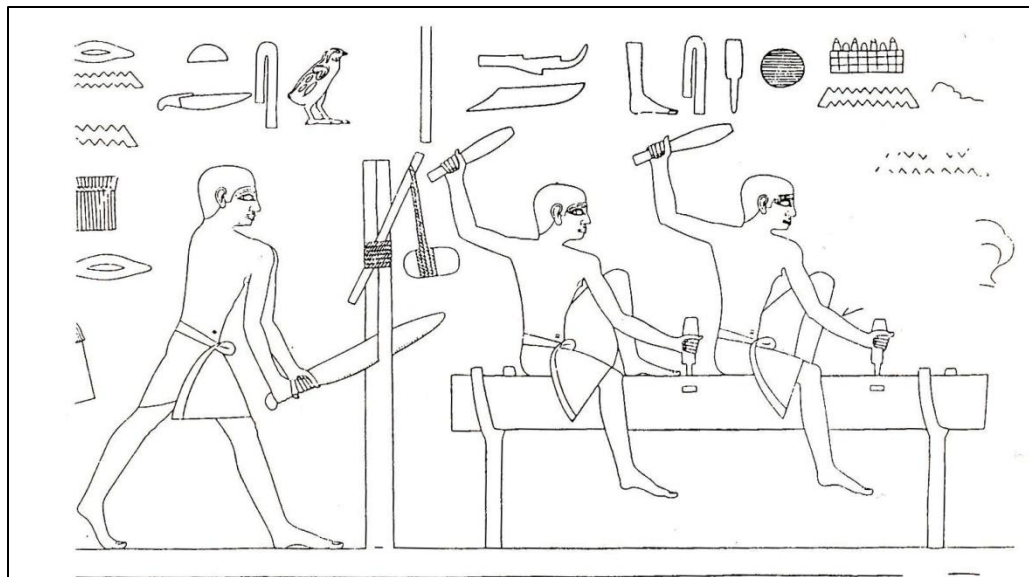
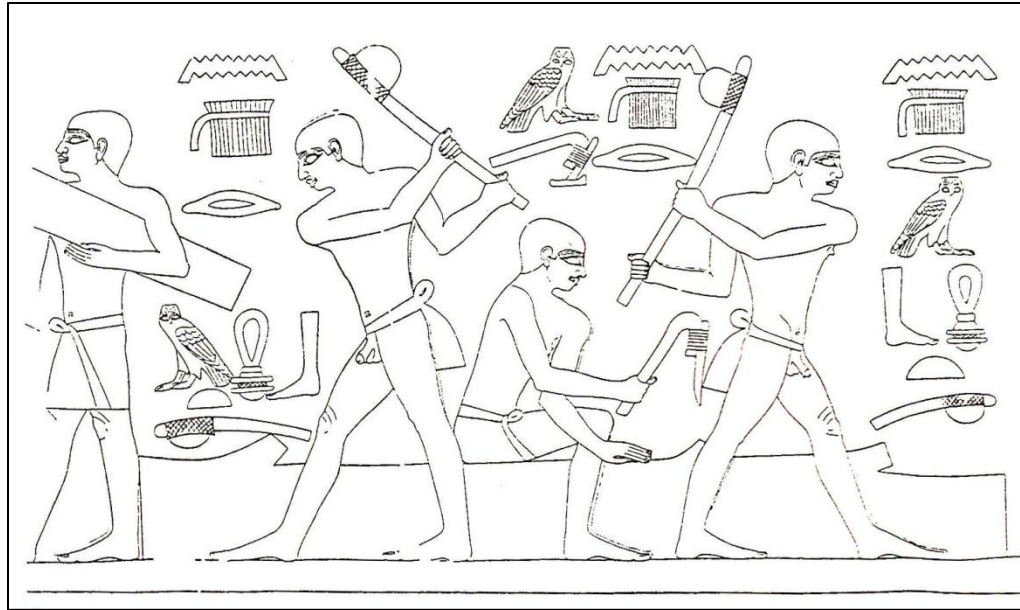
Probably 50 tons of cedar from the mountains of Lebanon was trans-shipped 400 miles



‘Bringing 40 ships filled with cedar logs. Shipbuilding of cedar wood, one “Praise-of-the-two-lands” ship, 100 cubits long...’

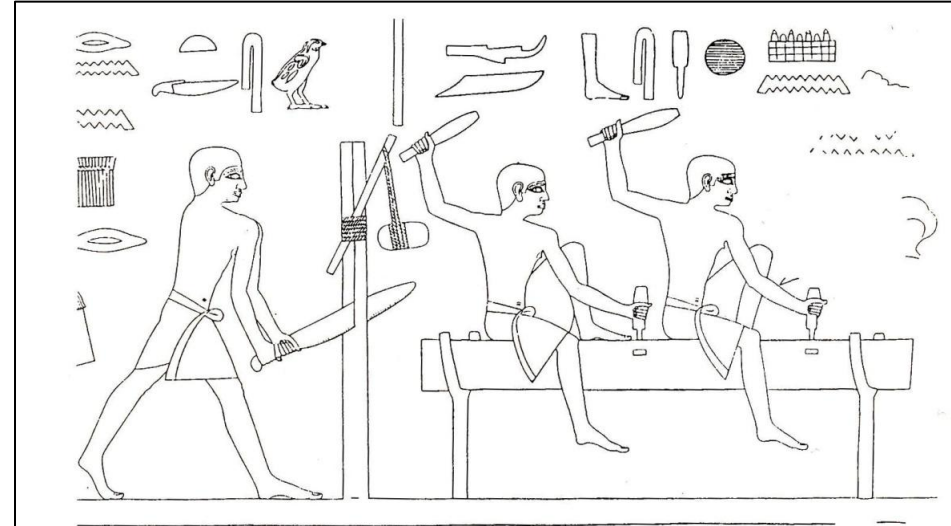
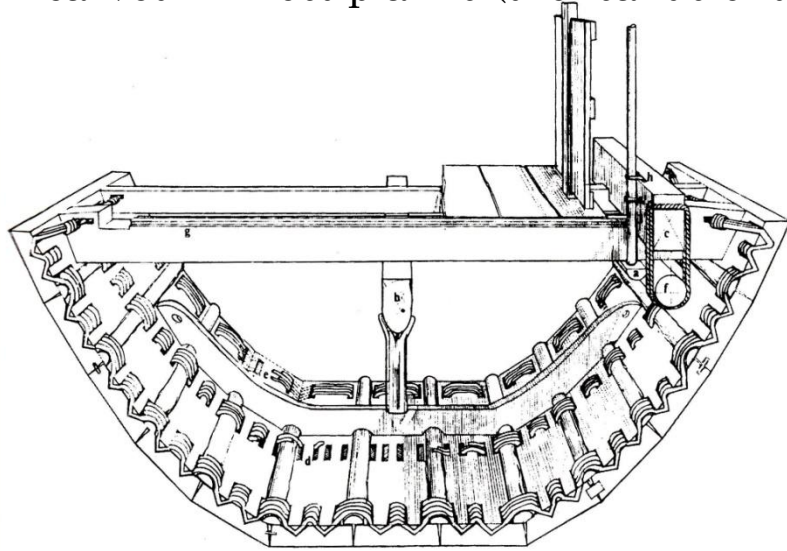
(Sneferu, 4th Dynasty ca. 2520-2470 BCE, father of Khufu)

The construction sequence begins (from the 5th Dynasty tomb Ti at Saqqara, ca. 2300 BCE)

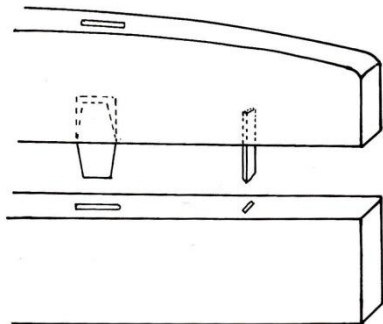
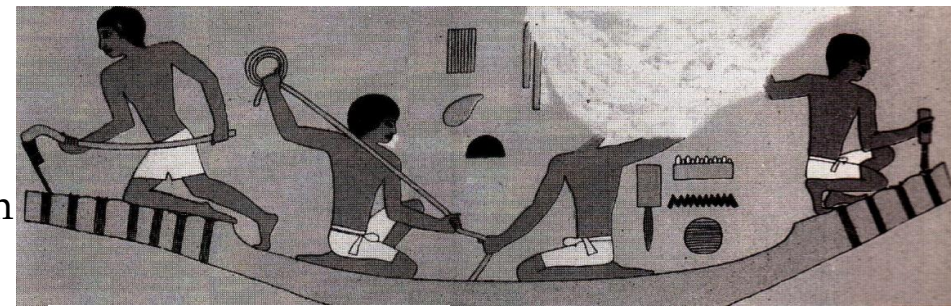


The two types of mortises carved in the planks of the Khufu barge

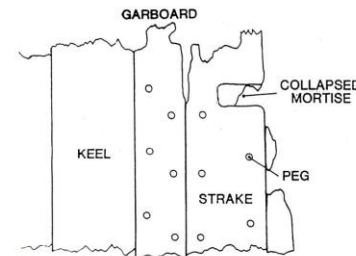
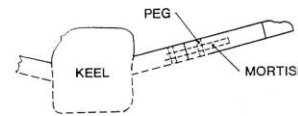
1. Two v-shaped lashing mortises are carved in most planks (thousands of them)



2. Mortise and tenons are used primarily to align the planks and they are not pegged like in ancient Mediterranean shipbuilding tradition



Khufu's barge

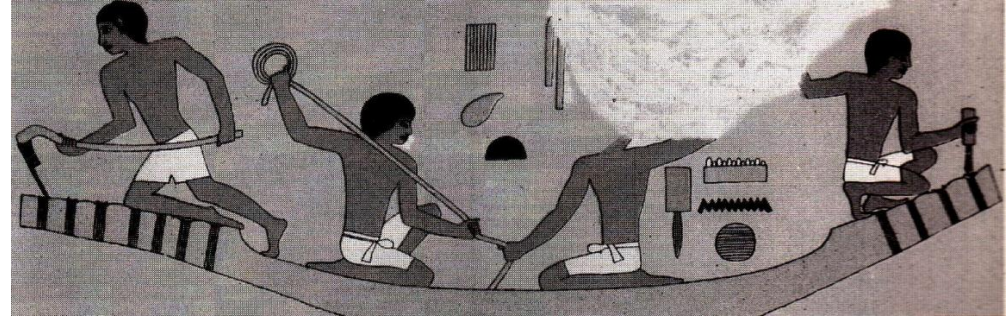
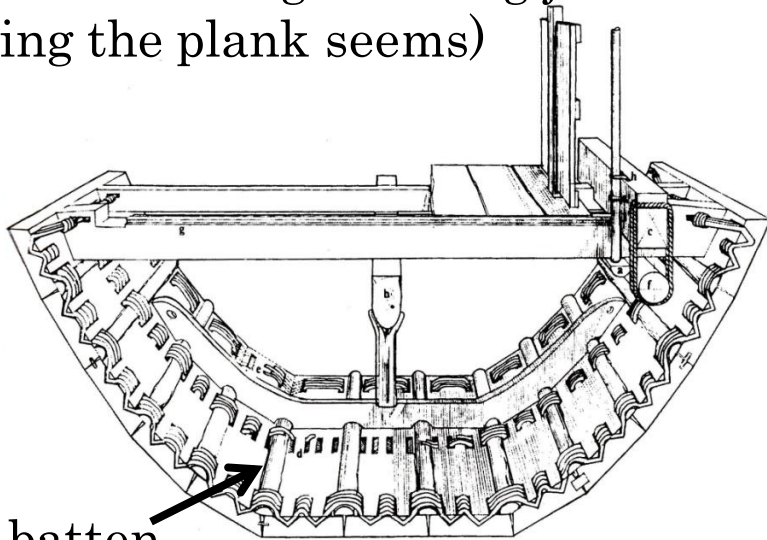


Ancient Mediterranean shipbuilding

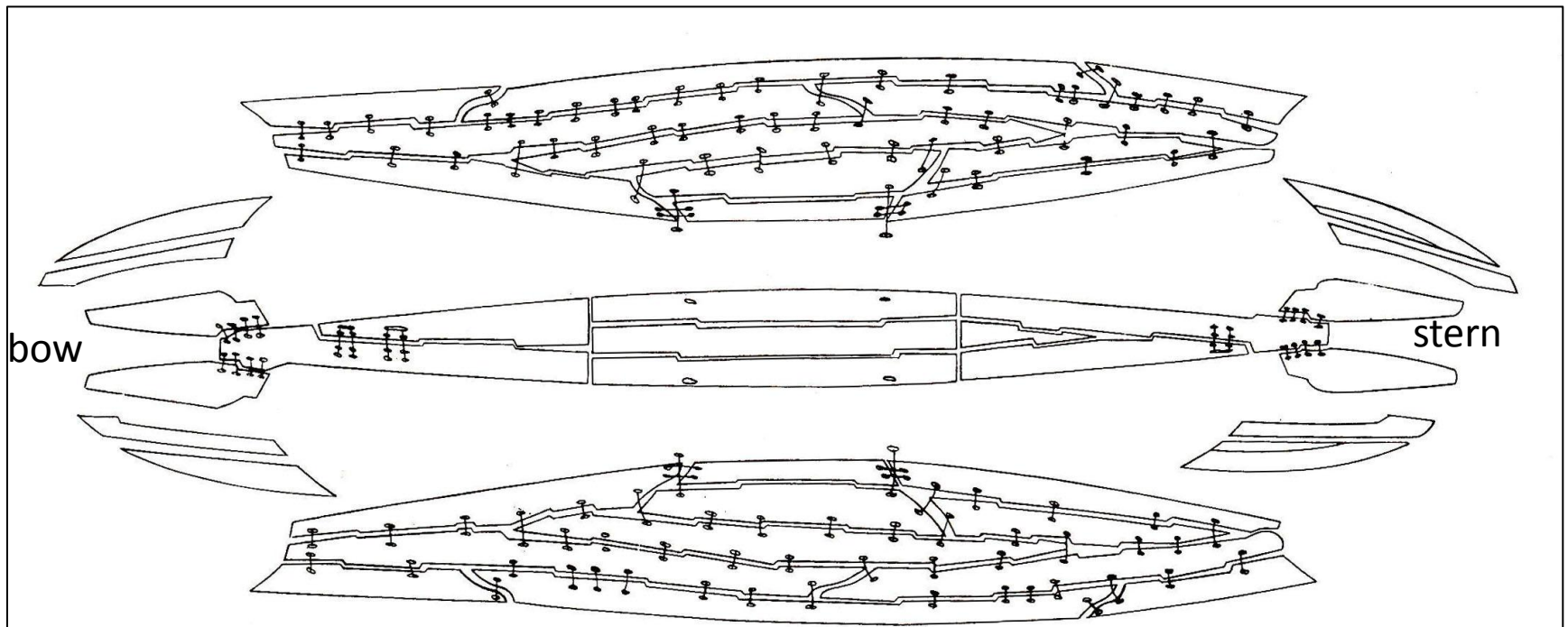
The rope for the lashing was stored in baskets in the Khufu barge burial
(one mile of rope would have been used to lash this barge)



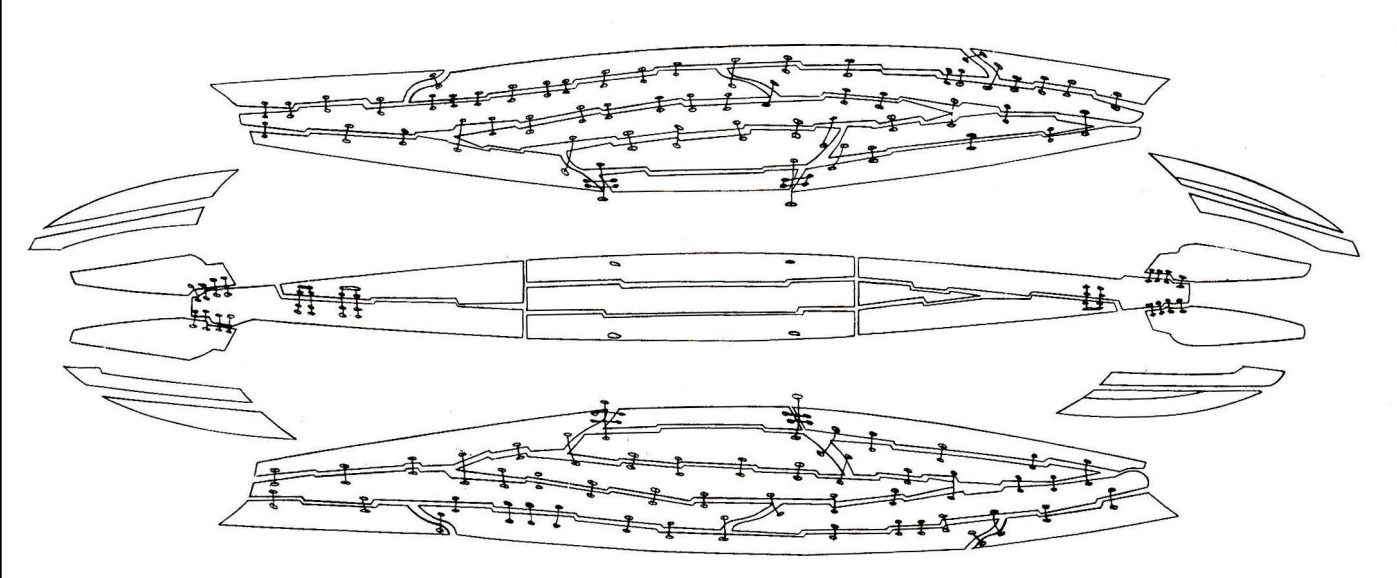
The bottom was assembled first with eight planks averaging 13 m in length (the most strategic lashing joints shown below—note also the lashed-down battens sealing the plank seems)



batten

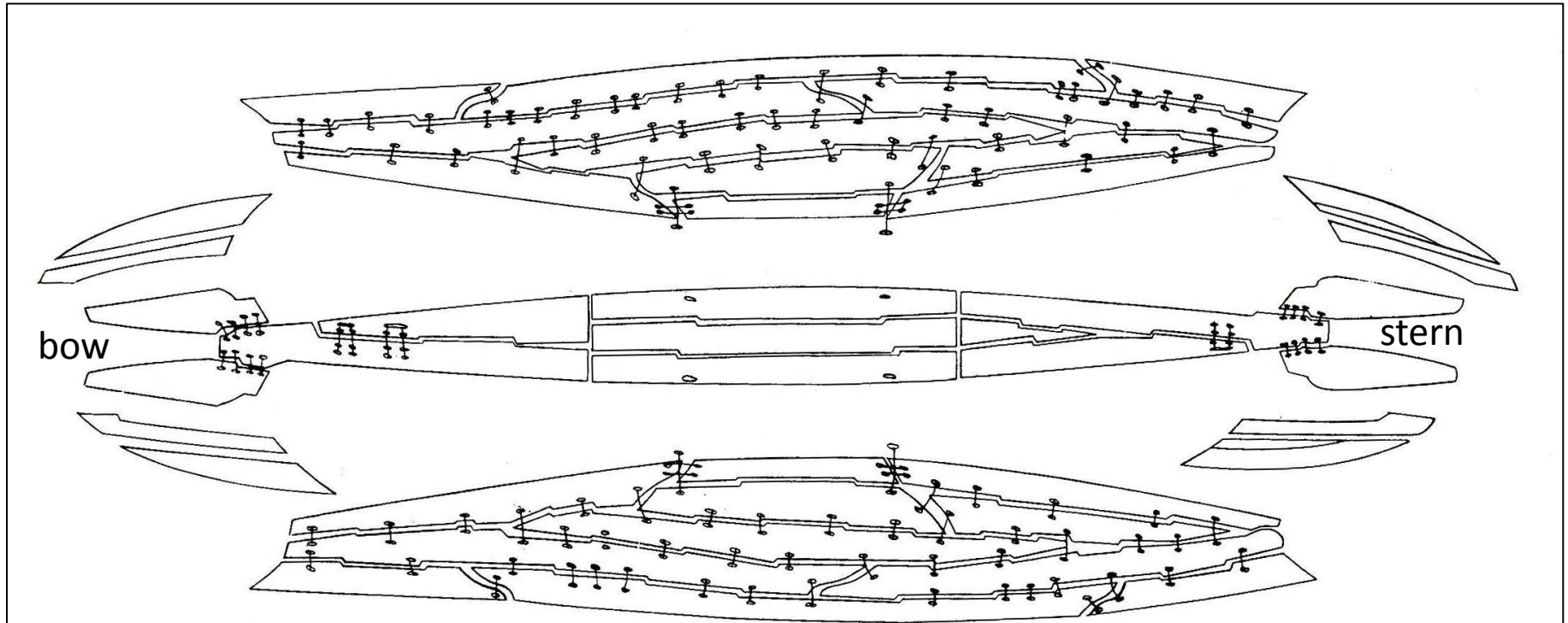
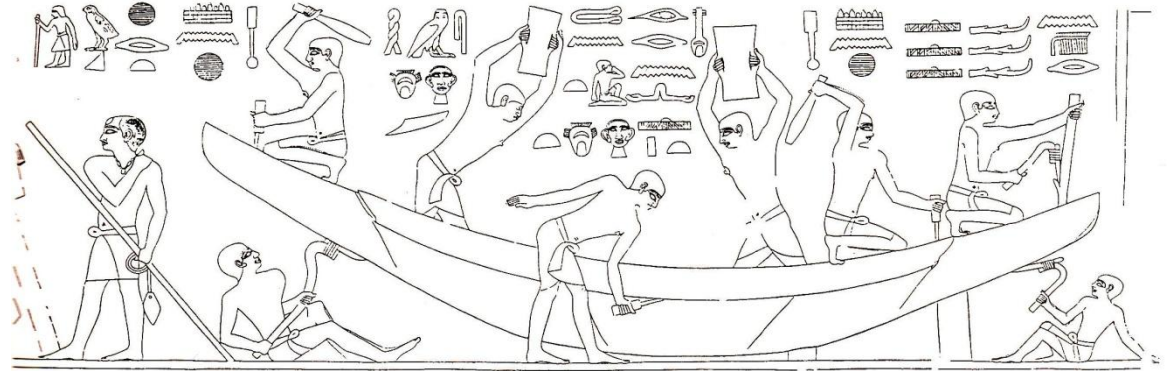
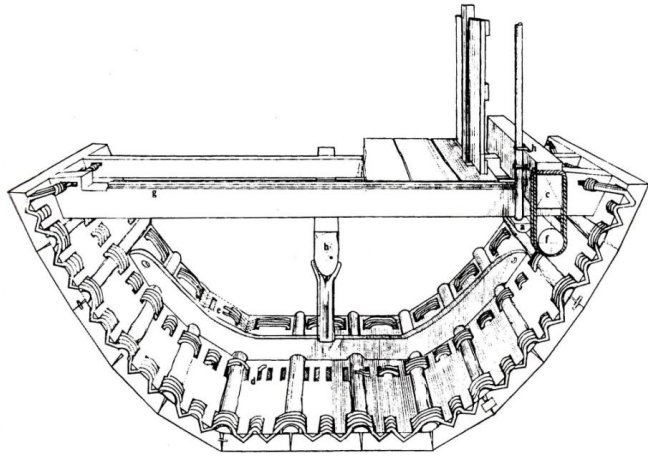


The dimensions and shape of the barge was guided by notches in the bottom planks

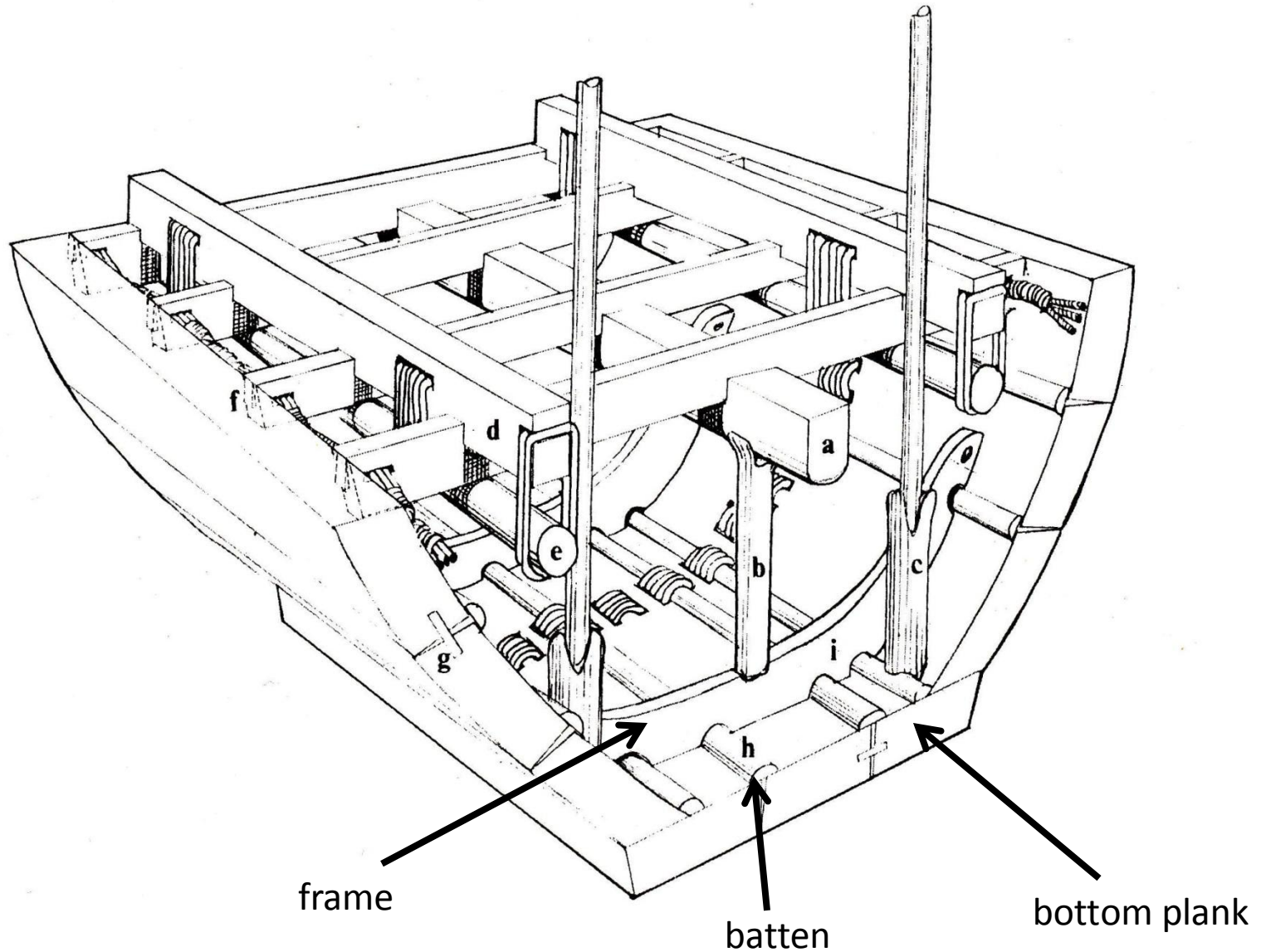


...revealing a degree of engineering (for reassembly in the cosmos?)

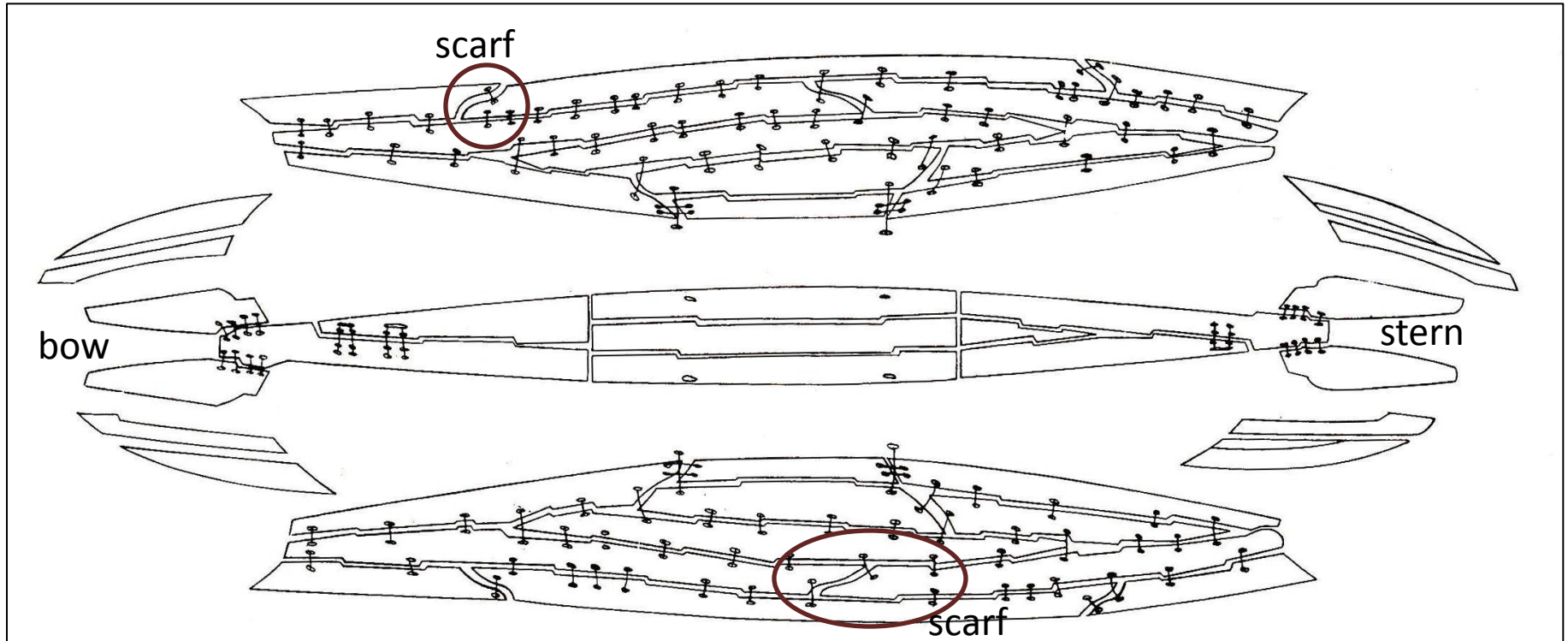
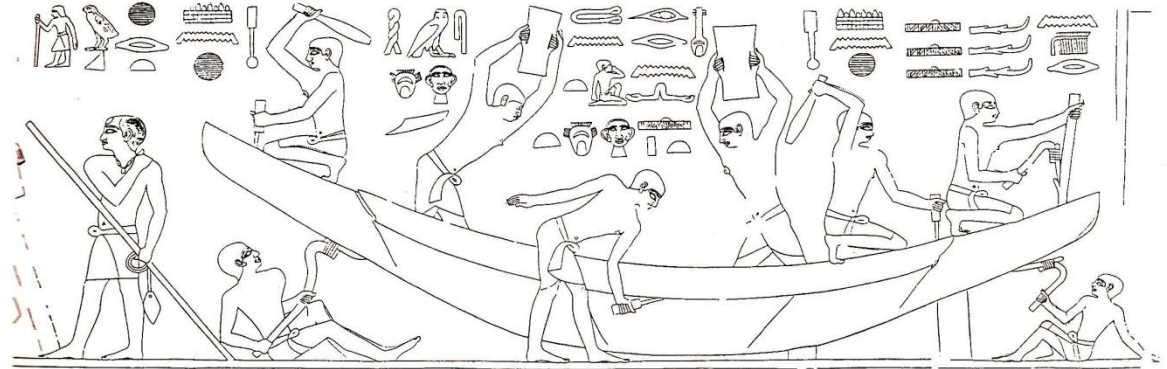
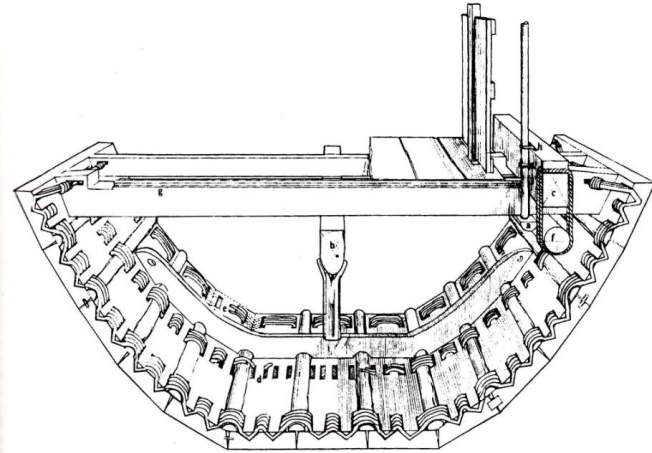
The sides are assembled next with 11 planks on each side ranging from 7-23 m



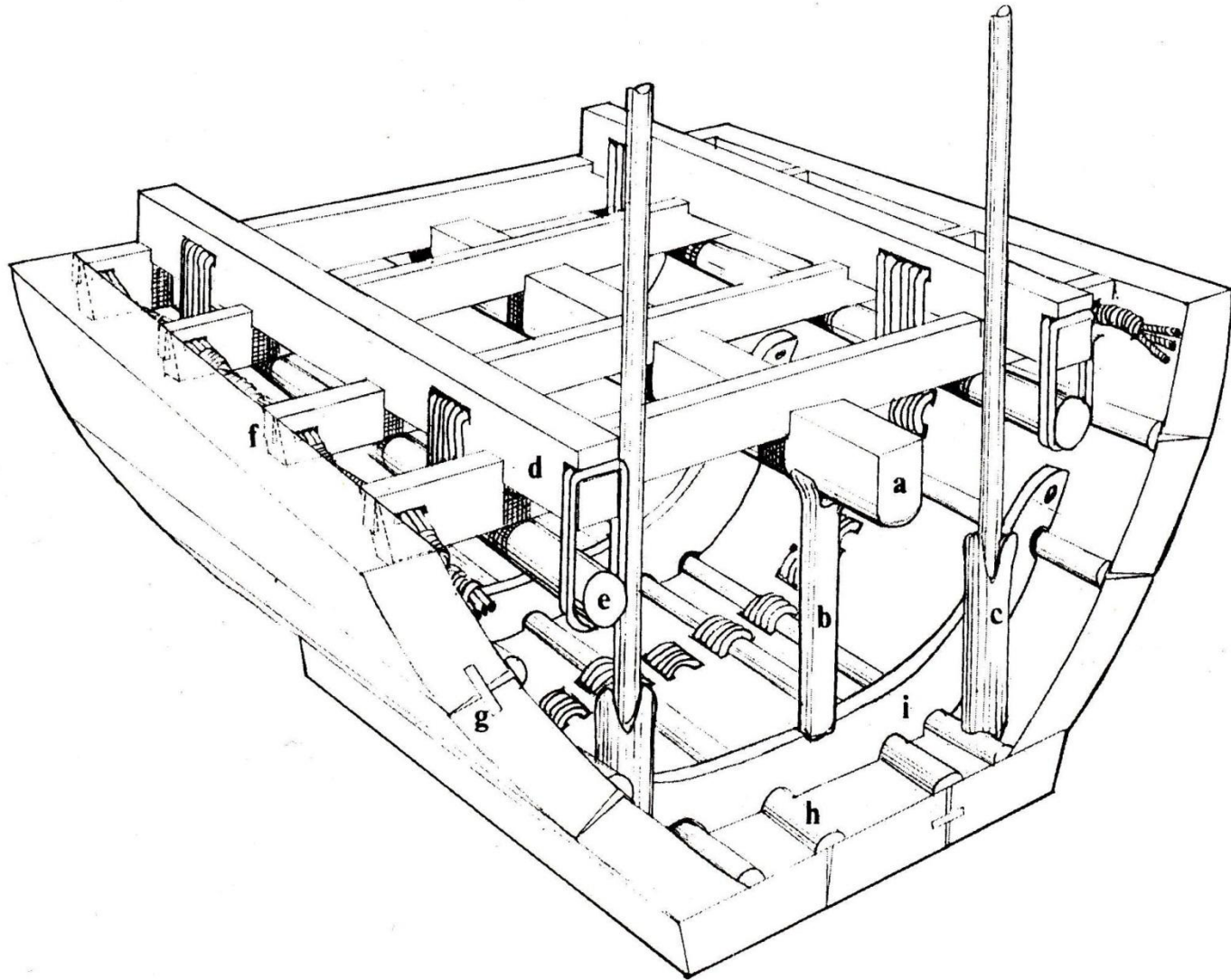
16 frames were shaped to fit the beam of the hull
(note the notching to accommodate the battens)



The Khufu barge belongs to the 'shell-first' tradition, where most of the longitudinal and lateral strength of the barge resides in the hull (extremely thick planks, scarfed to increase joining area between planks)

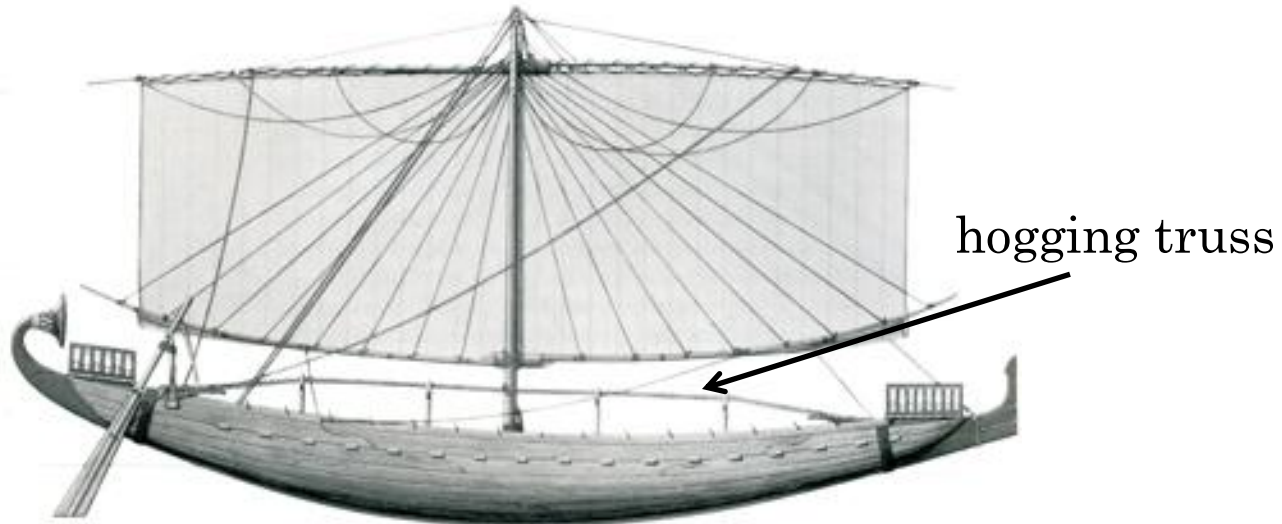
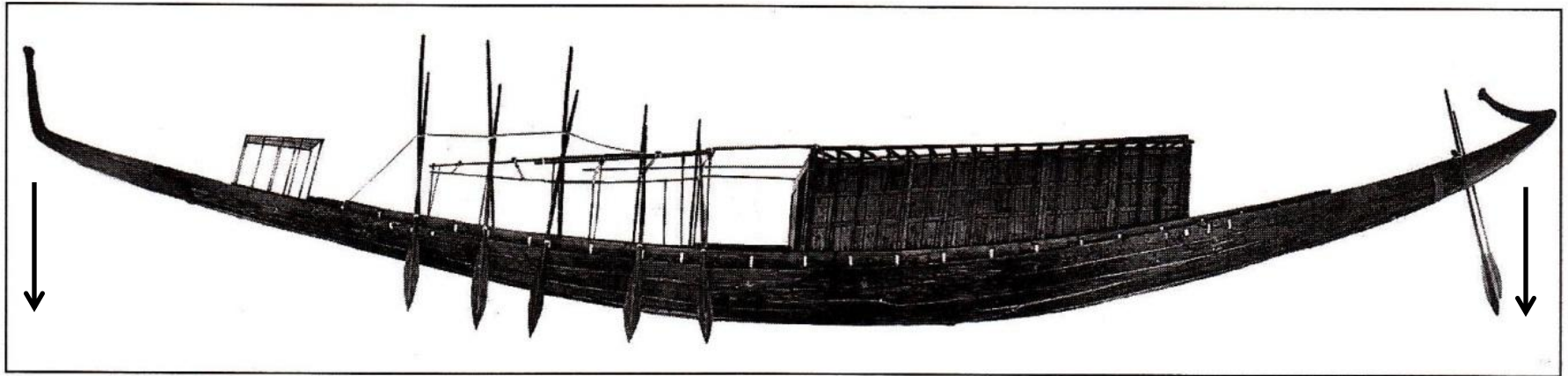


All 16 frames support a stanchion (b) which supports the central girder (a)



Different ways to contend with 'hogging' on Egyptian long boats and ships

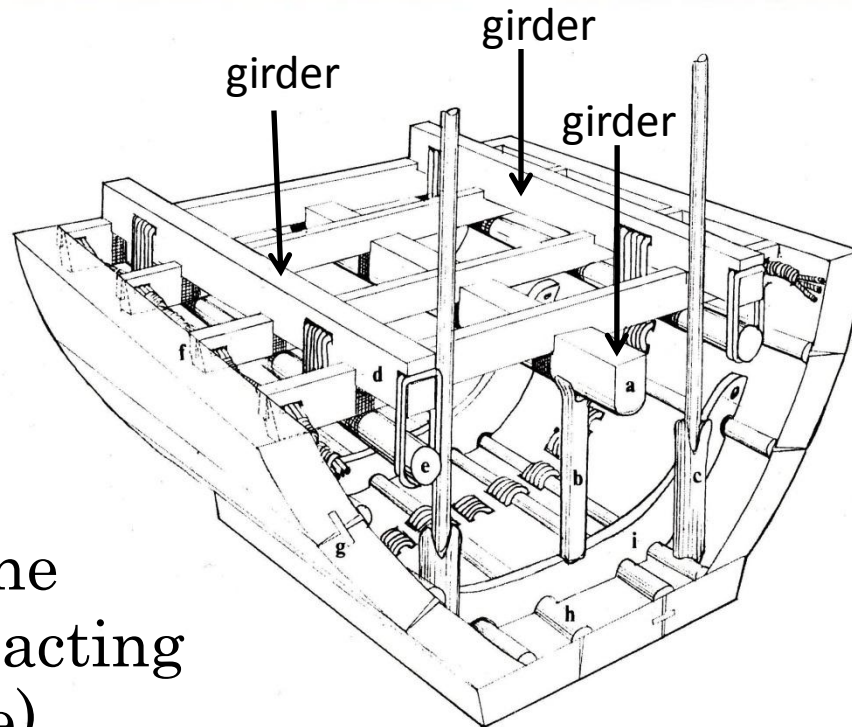
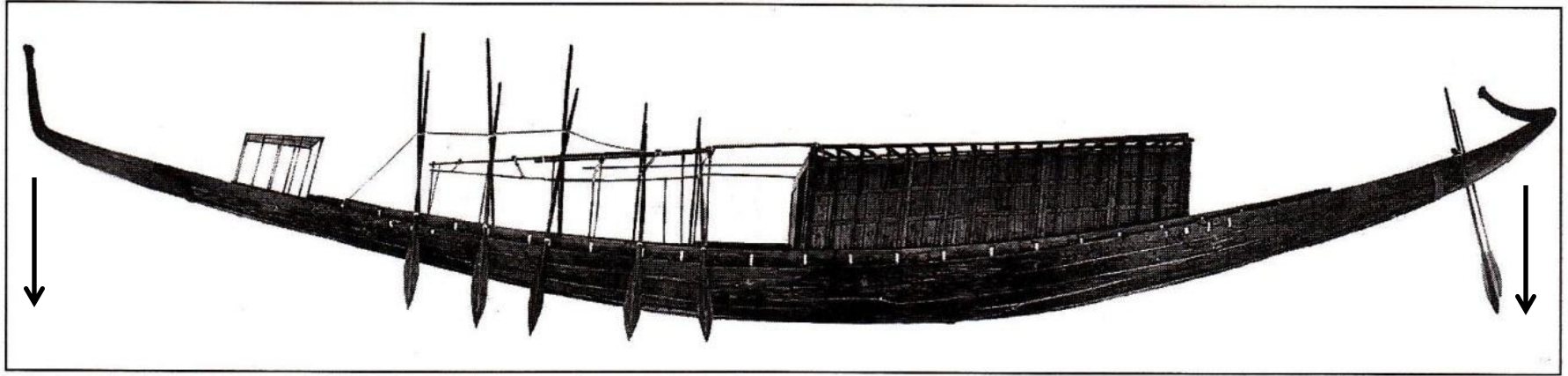
Khufu: bow to stern 43 meters



A hogging truss on Hatshepsut's seagoing 'Punt' ship—the Khufu barge was not fastened with one of these

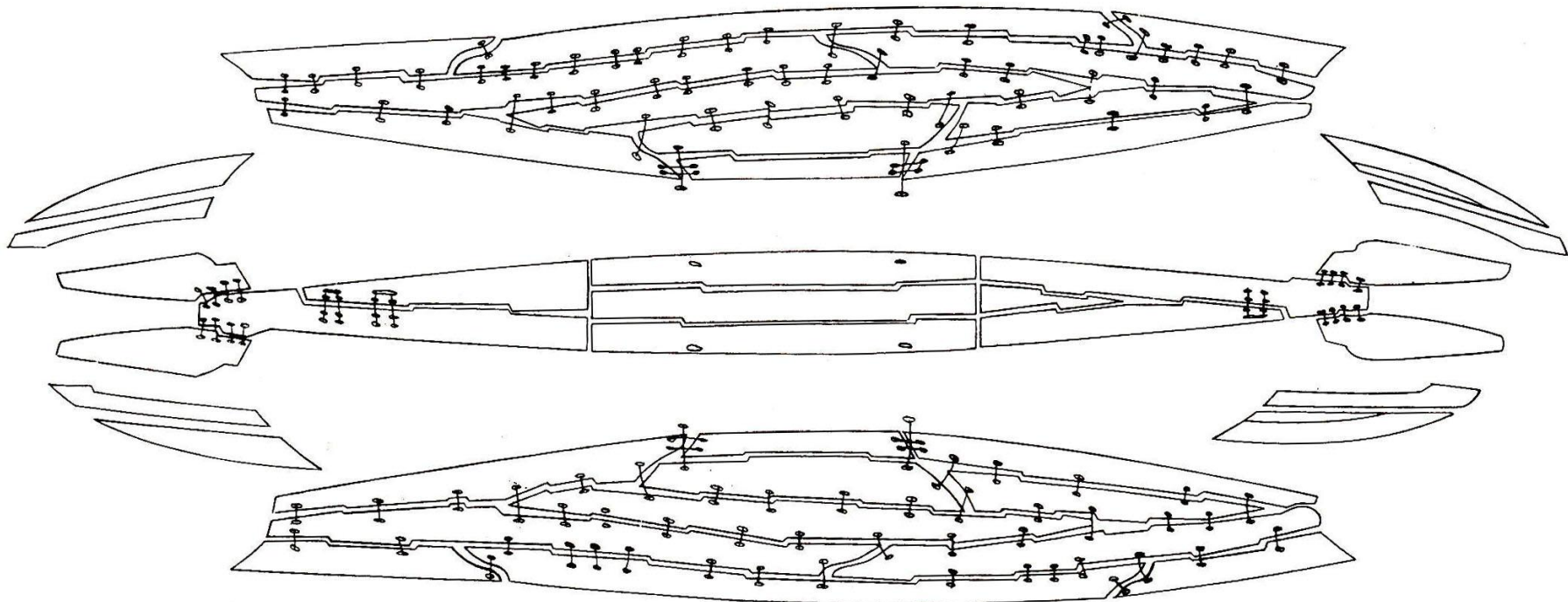
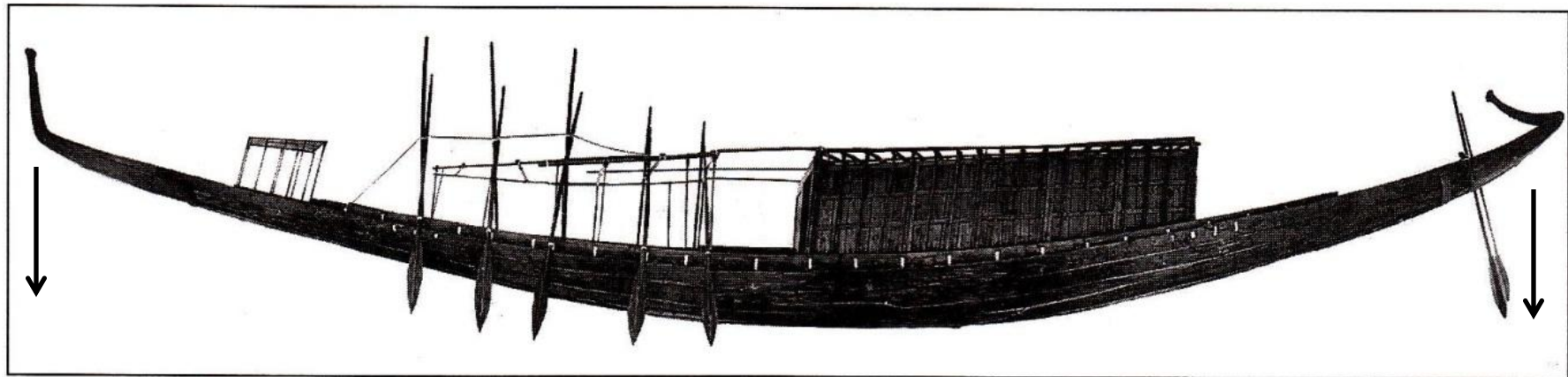
Different ways to contend with 'hogging' on long boats and ships

Khufu's barge: bow to stern 43 meters



Girders running the length of the boat acting like a keel (a spine)

Different ways to contend with 'hogging' on long boats and ships



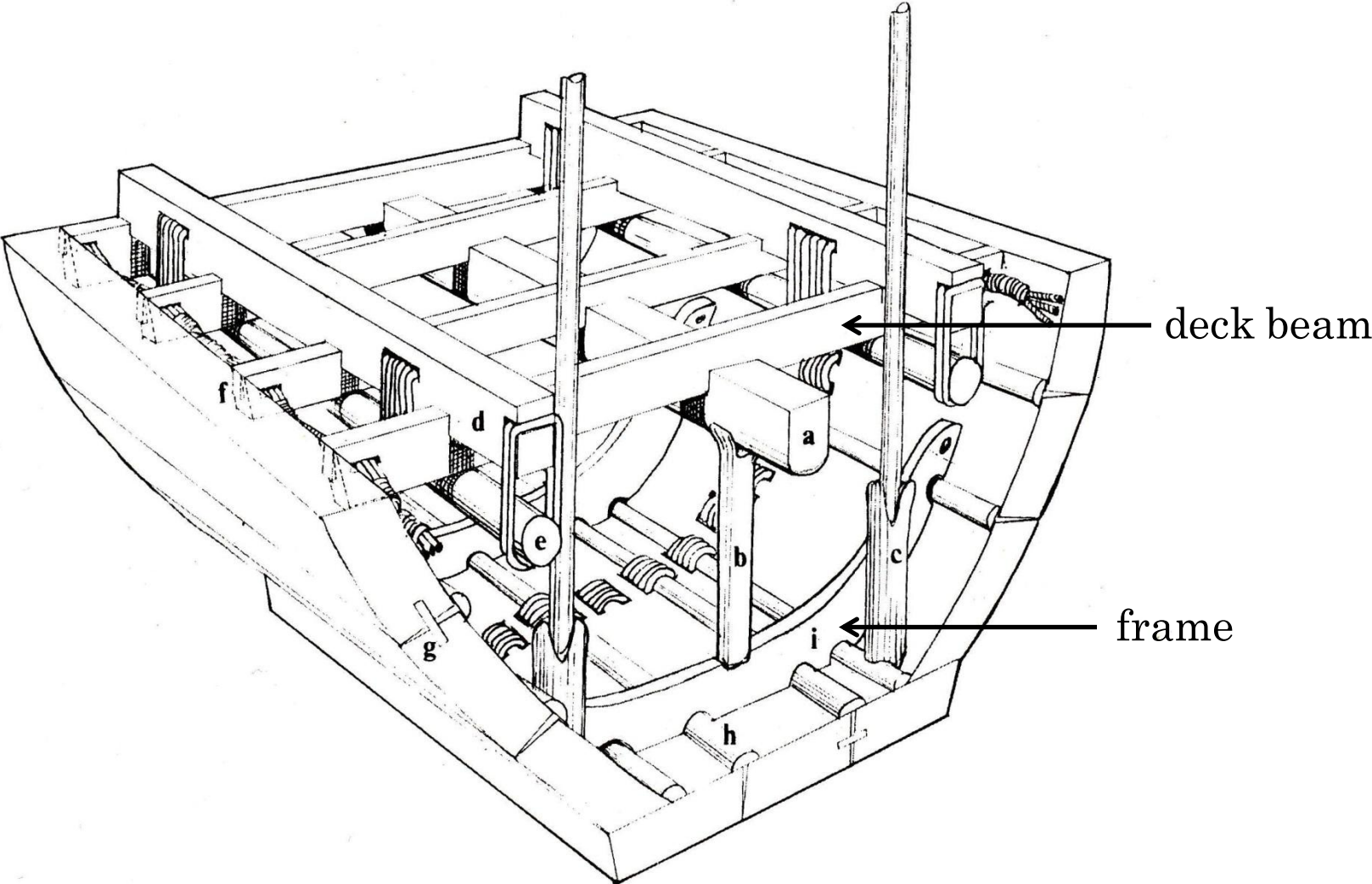
Shape of the planking (scarfed) also gave the boat more longitudinal strength, by increasing the joining area between the planks

And the sheer thickness of the planking (13 cm, most planks range from 7-9 cm)



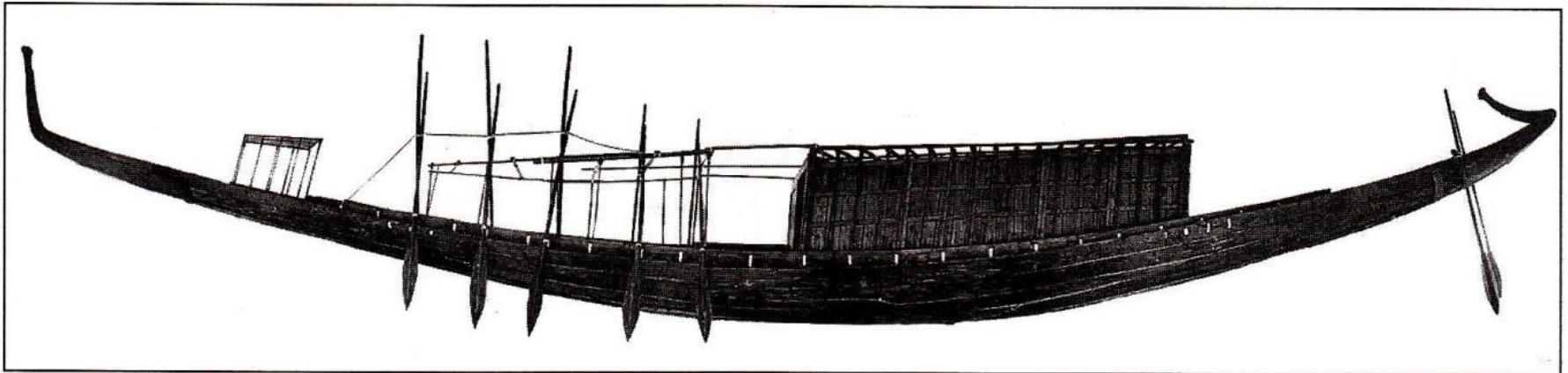
This is an extremely heavy boat: 38 tons of cedar!

66 deck beams (supporting the deck) provide additional lateral strength together with the 16 frames





‘Papyriform’ design: imitating the most ancient (and probably ubiquitous) boat design on the Nile in a ritual context

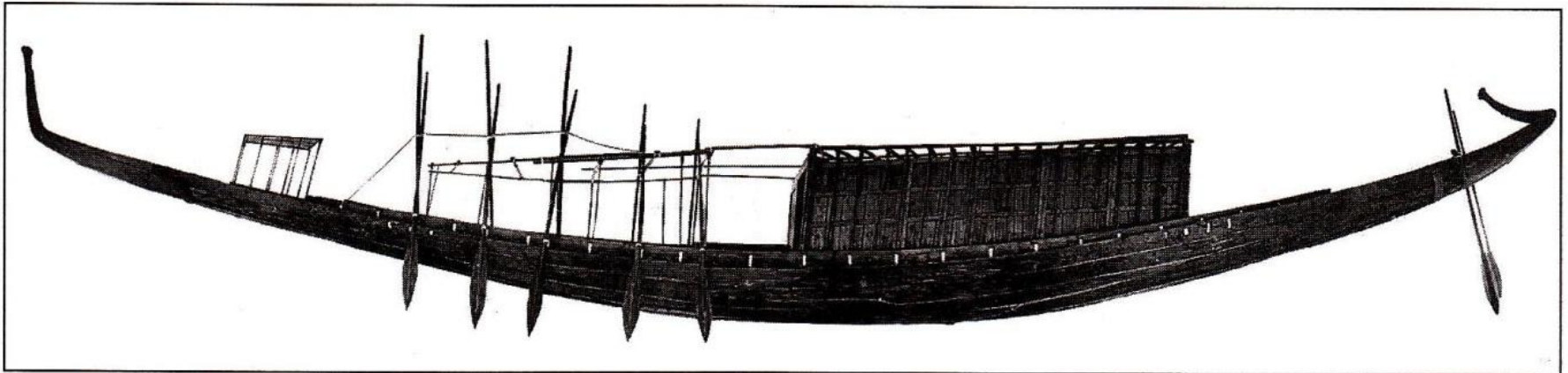




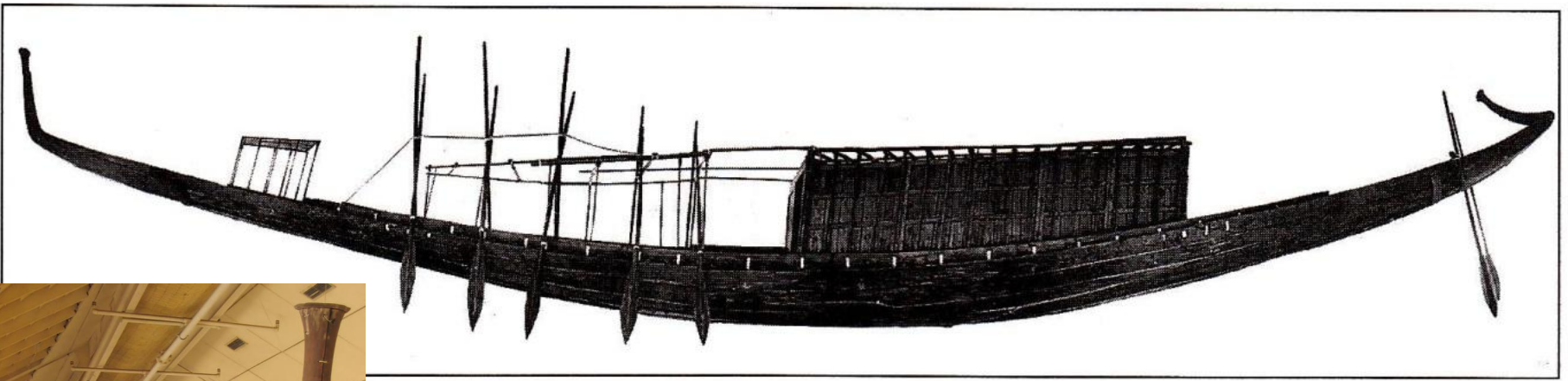
Propulsion, navigation and superstructure

Fully decked, supporting a deckhouse 9 m length
2.5 m height

Enormous oars and steering oars carved from single
pieces of cedar



Significant construction and design features of the Khufu barge



- * 38 tons of cedar went into the construction, probably 50 tons of cedar used
 - * the barge belongs to the 'shell-first' conception of ship/boat design
 - * lashed hull, most of the mechanical strength in the planks (thickness, scarfs)
 - * 'papyriform': design of the barge imitating the shape of a reed boat
- Question:** how much can this boat inform ancient Egyptian nautical technology as a whole, including seafaring technology?

What can archaeologists learn from the Khufu barge that cannot be learned with Egyptian boat/ship iconography?

