The Linguistic Evidence for Austronesian Watercraft Innovations

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1 Introduction

The Austronesian migration out of Taiwan into Insular Southeast Asia (ISEA) and Oceania represents one of the great feats of human history.

The foundation of this migration was Austronesian watercraft and seafaring abilities. Double-hulled, single-, and double-outrigger craft are ubiquitous with Austronesian migration and continue to be important parts of Austronesian culture.

The innovation of certain watercraft-building techniques, such as the innovation of the sail, the outrigger, and the double-hull, are said to have triggered certain pulses in the pulse-pause history of Austronesian migration (Blust 1999, Pawley & Pawley 1994).

(1) **Watercraft innovations and associated migration events**

a. Sail-driven craft were used to cross the Taiwan Strait.

b. Outriggers were used to cross the Strait of Luzon.

c. The accumulation of multiple additional innovations in both watercraft and sailing techniques were used to bridge the gap between near and remote Oceania.

But how do we know that these innovations are what triggered these various sea crossings?

Archaeological and paleoenvironmental evidence can only provide approximate dates for Austronesian arrival (Bellwood 2007, 2019, Kirch 2002). They do not tell us anything about how it was done.

(2) **Dates of AN arrival and their associated locations**

Date (BP)	**Area of AN Presence**
Before 5,000	Taiwan
Around 4,000	Northern Philippines
Between 3,500 and 4,000	ISEA
After 3,000	Remote Oceania

Our insights into the importance of watercraft innovation for Austronesian migration rest almost solely on observations from linguistics. **If a word is reconstructable to a certain Proto-Language, then the referent must have been present in the community that spoke that language.**

(3) **Linguistic evidence for important watercraft innovations (Blust, Trussel & Smith 2023: as originally presented)**

Innovation	**Form**	**Level**
Sail	*layaR	PAN
Boat; canoe	*qabaŋ	PAN
Paddle	*aluja	PAN
Bailer	*nimas	PAN
Outrigger	*saRman	PMP
(Outrigger) canoe hull	*katiR	PMP
Paddle	*bəRsay	PMP
Rudder	*quli[ŋ/n]	PMP

We offer a challenge to this interpretation of AN watercraft and migration history based principaly on a reevaluation of PAN and PMP lexical innovations:

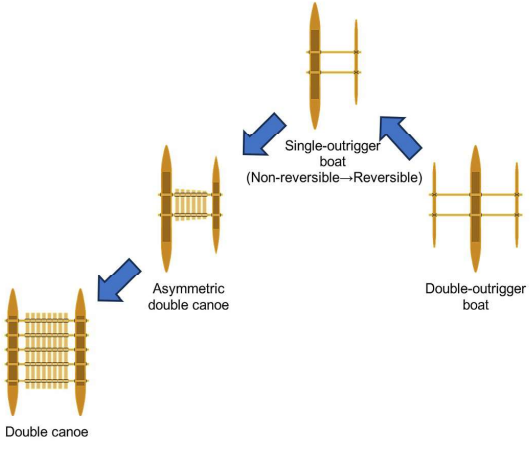
- The innovation of the outrigger was not the event that triggered Austronesian migration to the northern Philippines nor was it an integral part of PMP-speaking society (at least, not before the migration into ISEA had already begun).
- The innovation of the outrigger, and other watercraft innovations, took place in an environment of cultural and technological exchange that emerged after the initial movement to the Philippines.
- Sail-driven double-hulled craft were the likely means of reaching the Philippines.

This challenge is based on a reevaluation of the linguistic evidence.

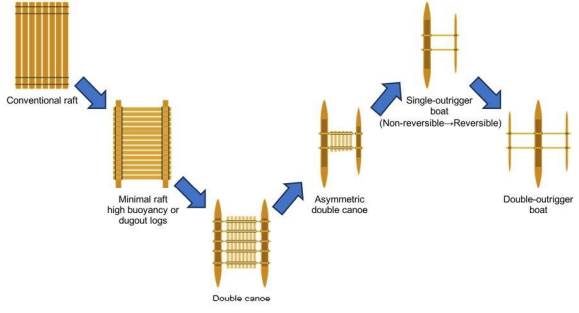
- Section 2: Review newer theories on the directionality of watercraft innovation.
- Section 3: The PAn word for 'boat'.
- Section 4: The PAn word for 'sail'.
- Section 5: The outrigger.
- Section 6: Conclude

2 Directionality of Single and Double outriggers and Double hulled canoes

Theories that credit the invention of the outrigger for triggering An migration to the Philippines assume that the outrigger was added to single hull craft, and was later enlarged to give rise to the double-hull.



This history of outrigger development has been challenged, however. Mahdi (1999, 2017), for example, argues convincingly that outriggers evolved from a gradual shrinking of the second hull:



It is not clear how the double-hull-first history of outrigger innovation can fit into a theory that credits the outrigger for triggering the An migration to the Philippines.

As it turns out, the linguistic evidence aligns much more closely with the double-hull-first theory than previously thought.

We now go through the reconstruction of key watercraft terms and reinterpret those reconstructions within our theory of An watercraft innovations.

3 What was the PAN word for 'boat'?

According to the ACD, PAN *qabaŋ 'boat, canoe' is supported by both Formosan and MP evidence, and is traditionally considered the principle term for 'boat' in PAN society. A summary of the evidence for *qabaŋ is shown below in example 4.

(4) Formosan: Kanakanavu *ʔaváŋɨ* 'boat, canoe' (Tsuchida 1971), Saaroa *ʔavaŋə* 'boat, canoe', Siraya *avaŋ* 'boat, sampan', Proto-Rukai *avaŋə 'boat, canoe', Tsou *apaŋə* 'boat, canoe', Favorlang/Babuza *abak* 'small boat or sampan'.

Malayo-Polynesian: Itbayaten *avaŋ* 'big boat with sail and oar', Gaddang *abaŋ* 'boat, canoe', Moken *kabaŋ* 'houseboat, group of Moken boats', Maranao *awaŋ* 'boat', Mentawai *abak* 'boat; travel by boat'.

Irregularities in the Formosan evidence are as follows:

- Proto-Rukai *avaŋə contains PAn *b → Proto-Rukai *v, instead of expected Proto-Rukai *b.
- Tsou *apaŋə* contains PAn *b → Tsou *p*, instead of expected Tsou *f*.
- Favorlang (Babuza) *abak* contains PAn *ŋ → Favorlang *k*, instead of expected Favorlang *n*.
- Saaroa *ʔavaŋə* contains a glottal reflex of *q instead of expected ∅.

This leaves Kanakanavu *ʔaváŋɨ* and Siraya *avaŋ* as the only remaining Formosan evidence.

However, a closer inspection of these words raises suspicions that they may ultimately have entered these languages via borrowing.

There is a history of lexical borrowing follows this basic pathway:

Philippines → Siraya → "Tsouic"

For example, Siraya *solat* 'writing' and *valituk* or *malituk* 'silver' likely entered Tsouic via this borrowing pathway. *solat* likely entered Siraya from the Philippines (Adelaar 1994: p. 60), and a similar history likely explains *valituk* or *malituk*: *cf:* Tagalog *balituk* 'gold ore' and Ilokano *balituk* 'gold ore'.

Siraya *solat* is found in Kanakanavu *sunatə* 'paper' and Hla'alua *sułatə* 'paper', and Siraya *valituk* ∼ *malituk* 'silver' are found in Kanakanavu *vanituku* 'money' and Hla'alua *vaɬituku* 'money'.

With this Philippines → Siraya → "Tsouic" history in mind, a similar distribution of supposed reflexes of *qabaŋ raises immediate red flags. With all other Formosan evidence similarly thrown out due to irregularities, we propose that Formosan witnesses entered Taiwan as borrowings.

*qabaŋ is also part of a group of words for boat that contain a common 'baŋ' element. This calls into question its reconstructability to even PMP.

Lexeme Form	Gloss	Note
qa**baŋ**	'boat; canoe'	Restricted to the Philippines and western MP (Moken and Mentawi only).
baŋkaq	'boat'	Mostly restricted to the Philippines and areas to the south of the Philippines excluding western Indonesia. Possible cognates are found in Melanesia.
waŋka	'canoe'	Well represented in eastern Indonesia and Oceania. Absent in western Indonesia and the Philippines. Melanesian reflexes of baŋkaq, listed above, may actually be loan distributions of waŋka.
waŋkaŋ	'(Chinese) ship'	Words with the final nasal are restricted to western Indonesia.
ko**fa**	'canoe'	A word found in the Timor region that cannot be reconstructed due to irregularities, but seems to reflect some borrowed word resembling *qabaŋ, possibly of a shape ˣkə baŋ (Edwards 2021: p. 393).

What replaces *qabaŋ?

We identify PAN *aluja 'to paddle' as a contender for 'boat' and furthermore show that the gloss 'to paddle' came from verbal derivation. A summary of the ACD evidence is shown below in example 5.

(5) Formosan: Thao *ruza* 'boat', *maka-ruza* 'to paddle a boat', *pa-ruza* 'boat, canoe; a canoe paddle', Kavalan *paluna* 'paddle, oar; to paddle, to row', Amis *lunan* 'boat', *pa-lunan* 'to paddle'.

Malayo-Polynesian: Palauan *mə-ius* 'row, paddle, stir', Gaddang *paluwa* 'to paddle', Subanen *pɨlula* 'to paddle', Toba Batak *mar-luga* 'to row, pull an oar', Likum *heluh* 'to paddle', Tolai *alus* 'to paddle', Cheke Holo *valuha* 'paddle', Bonkovia *walua* 'paddle'.

Reflexes of *aluja are also widespread in Kra-Dai. Kra-Dai evidence is shown below in example 6. Note the greater restriction in semantics: All Kra-Dai reflexes mean 'boat', never 'to paddle' or 'a paddle'.

(6) Proto-Tai *Ç.rwɯə^{A} 'boat', Proto-Hlai *ura^{A} 'boat', Proto-Ong-Be *zua^{A2} 'boat', Proto-Kra *da 'boat'.

These various data points require two major revisions to the ACD reconstruction *aluja.

1. (Formal revision) PAN *aluja → PAN *luja.
2. (Semantic revision) PAN *luja ‘to paddle’ → *luja ‘boat’ / *pa-luja ‘to paddle, operate a boat’

4 PAn *layaR ‘sail’

The ACD lists *layaR as the noun ‘sail’, in reference to the sails of boats. This word implies a PAn-speaking sailing culture in Taiwan and has been used to posit that the journey from Fujian to Taiwan took place on craft with sails (Blust 1999). A summary of the ACD evidence is shown below in example 7.

(7) Formosan: Kavalan RayaR ‘sail of a raft or boat; cloth around a threshing machine’, Paiwan *la-laya* ‘a flag or banner’, Amis *layal* ‘to hang clothes to dry in the sun’ (Rata 2019).

Malayo-Polynesian: Tagalog *láyag* ‘sail; sailboat; to sail’, Chamorro *layak* ‘mast; sails’, Palauan *yars* ‘sail’, Ida’an Begak *layag* ‘a sail’, Malagasy *lay* ‘a tent; a sail’, Tetun *laa-n* ‘sails of a boat’, Motu *lara* ‘a sail’, Hawaiian *laː* ‘sail; dorsal fin’.

Formosan evidence for ‘sail’ turns out to be rather weak.

Semantics:
Both the Paiwan and Amis reflexes do not mean sail, but rather refer to hanging cloth.

Borrowings of potential but irregular *layaR reflexes with the meaning ‘flag’ are common in Taiwan:

Puyuma *laya* ‘flag’ (expected *layar*), Bunun *laia* ‘flag’ (expected Proto-Bunun *haðal, northern/central Bunan *haðal*, southern Bunun *ʔaðal*), and Saisiyat *lalayar* ‘flag’ (expected Proto-Saisiyat *ɬayaɬ, Tungho Saisiyat *aya*) (*Online Dictionary for Indigenous Languages* 原住民族線上辭典 2021)

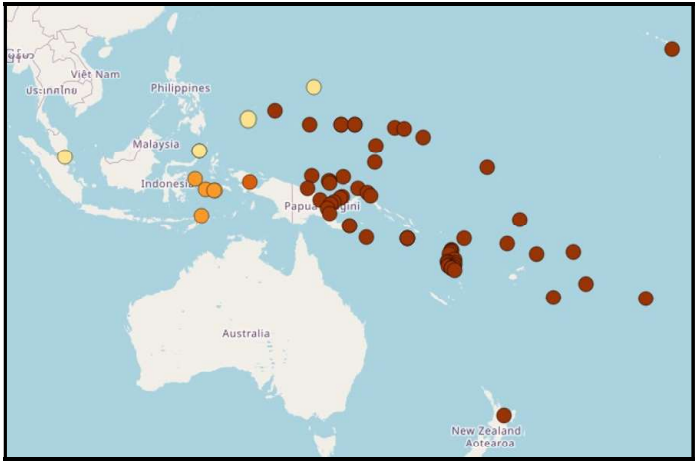
Distribution:
The only semantically correct reflex is found in Kavalan, which is an East Formosan language. East Formosan languages have a particularly heavy MP influence in their lexicon. Some go as far as to subgroup EF with MP (Chen et al. 2022).

Considering both the semantic and distributional issues with this reconstruction, we propose that *layaR is a good candidate for MP-borrowing into Taiwan, rather than inheritance from PAn.

It is well-suported at the PMP level, but has issues at the PAn level.

5 The Outrigger

The ACD reconstruction for 'outrigger float' is PMP *saRman, and reflexes are restricted to MP. The distribution of reflexes of *saRman is mostly restricted to eastern Indonesia and Oceania, as shown here:



The evidence used to reconstruct *saRman is inconsistent and contains numerous irregularities in correspondences that make reconstruction exceptionally difficult. In example 8, conflicting reconstructions are shown with various supporting reflexes. In the ACD, all of these words are listed under *saRman, but clearly there is no single reconstruction that is supported by the data.

(8)

*saRman:	Chamorro *sakman*.
*səRəma[ŋ/n]:	Sangir *sahəmːaŋ*.
*səmaŋ:	Malay *səmaŋ*.
*səman:	Buru, Asilulu, Erai *seman*, Wetan *semna*, Wandamen *soman*.
*saman:	Oceanic languages.
*s[a/ə]mən:	Maˈya *ˈsomo*^{3}*n*.
*oman:	Ambel *omán*.
*təRəman:	Palauan *ðəsóməl*.

These facts force a reevaluation of the PMP reconstruction for outrigger and by extension its role in crossing the Strait of Luzon.

Blust 2013: p. 749, referring to the "first pause" in Taiwan that preceded the AN expansion into ISEA, claims that: "[The pause] was finally broken with the invention of the outrigger canoe complex... a cultural attribute that is richly attested outside Taiwan and in linguistic reconstructions for PMP [here referring to *saRman], but not for PAN".

The linguistic evidence, as shown in this section, does not actually support Blust's conclusion. Instead, the outrigger must have entered MP culture sometime after PMP.

Conflicting evidence for PMP *saRman, which is actually a near-cognate set with variations pointing to a ^{x}s[a/ə](R)(ə)m[a/ə]n near-cognate complex, suggest that that term entered the MP vocabulary after PMP began to diversify, with slightly different forms reflected in the various recipient languages.

It seems that the outrigger was not necessary to cross the Luzon Strait, and that the seafaring technology that today defines MP societies was integrated and developed during and after the expansion into ISEA in a dispersed but interconnected MP society.

6 Conclusion

So, by what means did An people settle the Philippines?

(9) **Seafaring lexicon at PMP and post-PMP levels**

a. *luja 'boat; to paddle', *bəRsay: 'paddle', *layaR 'sail', *limas 'bailer', *katiR 'hull of a (double) canoe' (found in the Philippines, western Indonesia, and Western Oceanic).

b. ˣqabaŋ 'boat; canoe', ˣs[a/ə](R)m[a/ə]n 'outrigger float', ˣbaraŋ(g)ay 'kind of large boat', ˣalud 'type of canoe (no outrigger)', ˣduluŋ 'prow of a canoe', ˣpa[d/r]a(q)u 'boat', ˣbanduŋ 'pair of boats joined by a connecting platform', ˣkaRəm 'capsize', ˣlunas 'keel; hull', ˣquli[ŋ/n] 'rudder; steer a boat'

Based on this evidence, the best candidate is sail-driven craft. Furthermore, the evolution of the outrigger suggested by Mahdi implies that those craft may have been double hulled, and that the double hull evolved into the outrigger over time after the initial move to the Philippines.

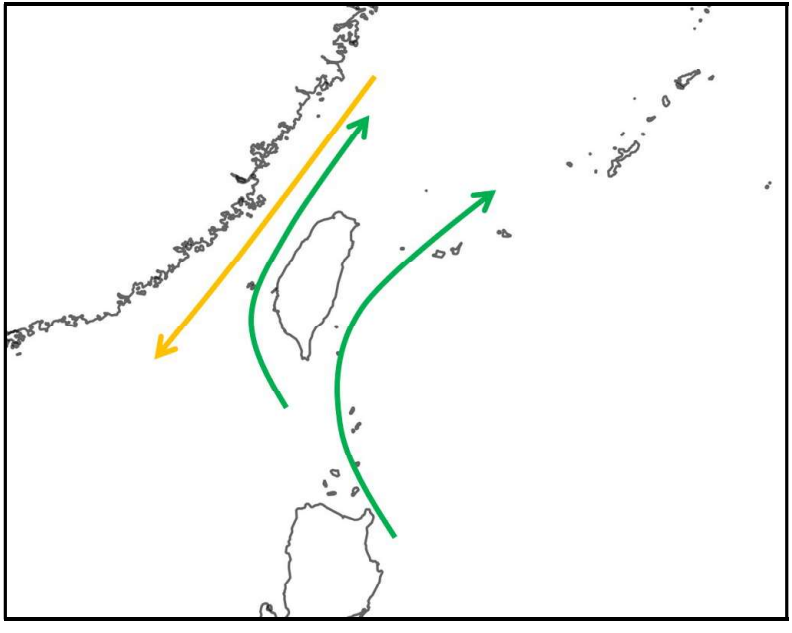
Appendix: The Journey to Taiwan

Archaeological evidence suggests that PAn speaking people migrated to Taiwan from coastal Fujian (Kuo 2019, Chang 1989). Taiwan was settled before 5,000 BP and cross-strait travel was likely sustained for some time (Rolett, Chen & Sinton 2000). This implies that An speaking people may have existed simultaneously on both sides of the Taiwan strait and maintained contact with one another, but Archaeological evidence for an An presence in the Philippines, including the Batanes islands, does not appear until closer to 4,000 BP.

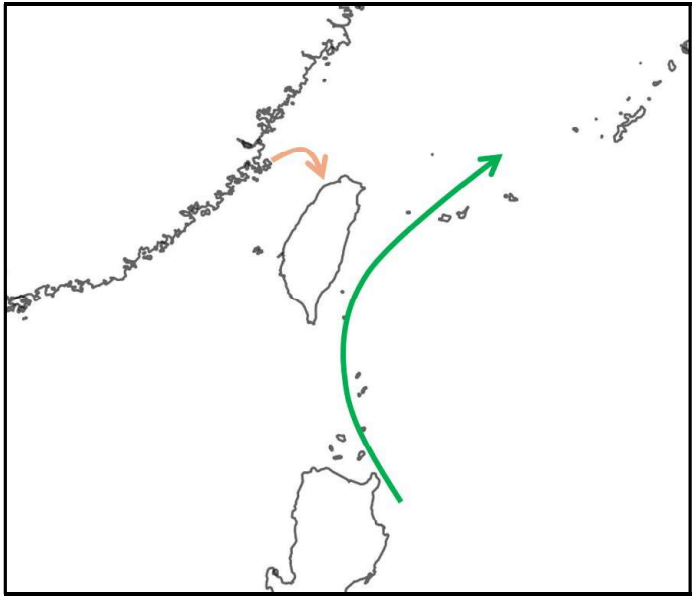
The average width of the Taiwan strait is 180 kilometers, and just 130 kilometers at its narrowest point. This is not any closer to Taiwan than Lanyu Island or the Batanes Islands; Lanyu is only 60 Kilometers away from the Taiwan mainland and Itbayat Island is only 150 kilometers away.

Something must have changed between the time An speaking people crossed the Taiwan strait and the time they arrived in the northern Philippines, and if it was not the outrigger, than what was it?

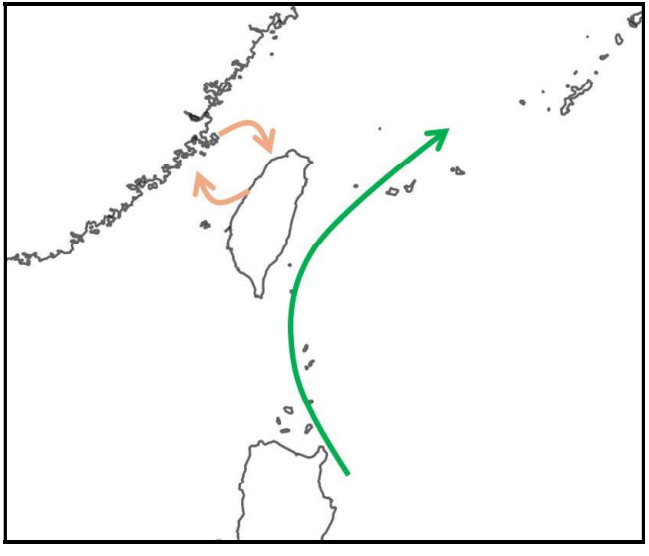
Currents in the Taiwan strait are defined by the complex interaction of the Taiwan Coastal Current (TCC), a branch of the strong northward flowing Kuroshio Current, and the southward flowing China Coastal Current (CCC).



During winter the weakening of the TCC create cross-strait flows that originate from the Fujian coast and move towards Taiwan. This cross-strait flow causes surface debris to drift from areas near Pingtan Island to the coast of northwest Taiwan (Oey et al. 2014).



Later in the year, back-flows occur which may bring people back to the Mainland.



In the PAn context, paddling a canoe with the current during late winter could bring settlers to Taiwan relatively quickly.

Relying on paddle-power and currents to traverse the Strait of Luzon is not possible. The Kuroshio Current flows swiftly northward away from the Philippines all year. There are no seasonal changes in the currents flow and it remains relatively strong.

The only practical method for voyaging to and from the Philippines, including the Batanes Islands and Lanyu Island, was to use sails to travel with the wind and against the current.

Environmental conditions therefore indicate that 1) sailing was not necessary for crossing the Taiwan Strait, but 2) it was necessary to cross the Luzon Strait.