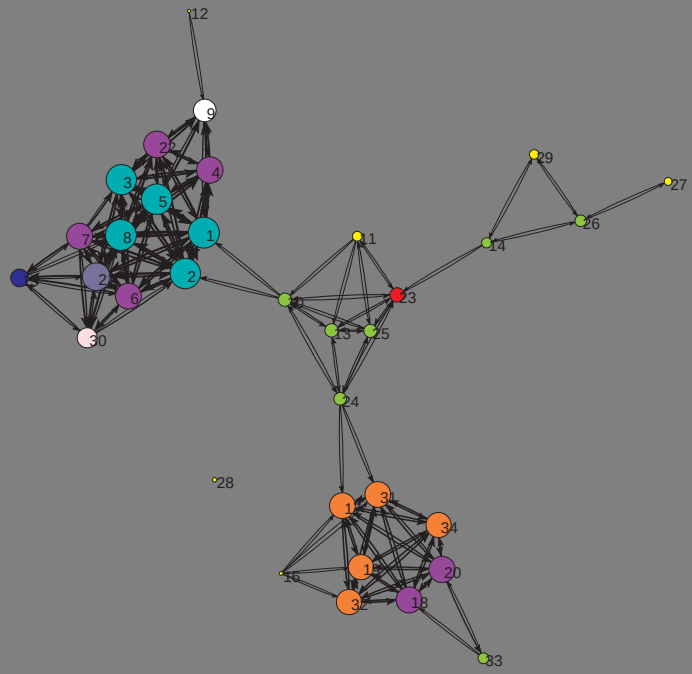
ISCOM Final Meeting – Venice May 20-24 ‘06

Using Statistical Physics to Understand Relational Space: A Case Study from Mediterranean Prehistory



Carl Knappett , Ray Rivers and Tim Evans

An analysis using network tools of a socio-physical phenomenon

Socio-physical phenomena exist at a range of scales:

1. **Micro-scale – e.g. bodily space - pedestrian flows**
2. **Meso-scale – e.g. community space – urban dynamics**
3. **Macro-scale – e.g. regional space – community interactions**

Our focus is on the interaction between meso- and macro-scale

- Why use the term ‘socio-physical’ ?
- what we intend to convey is the articulation of the social and the physical non-deterministically
- Alternative terms: **relational** and **physical** space
- The challenge - to understand the relative contribution of the social and the physical in different conditions – is not inconsiderable

So, what is our focus?

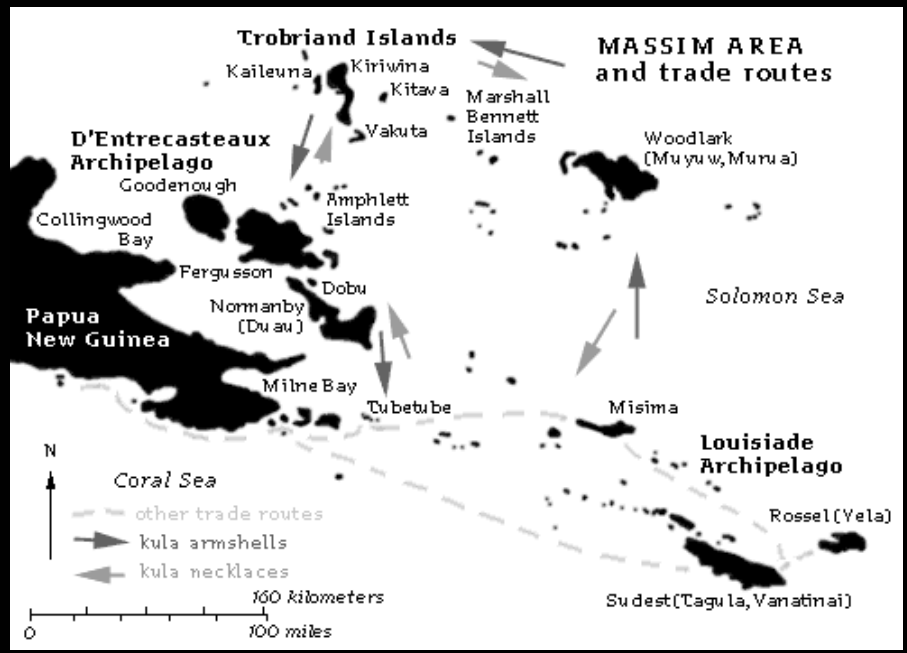
Aegean archipelago as a socio-physical system

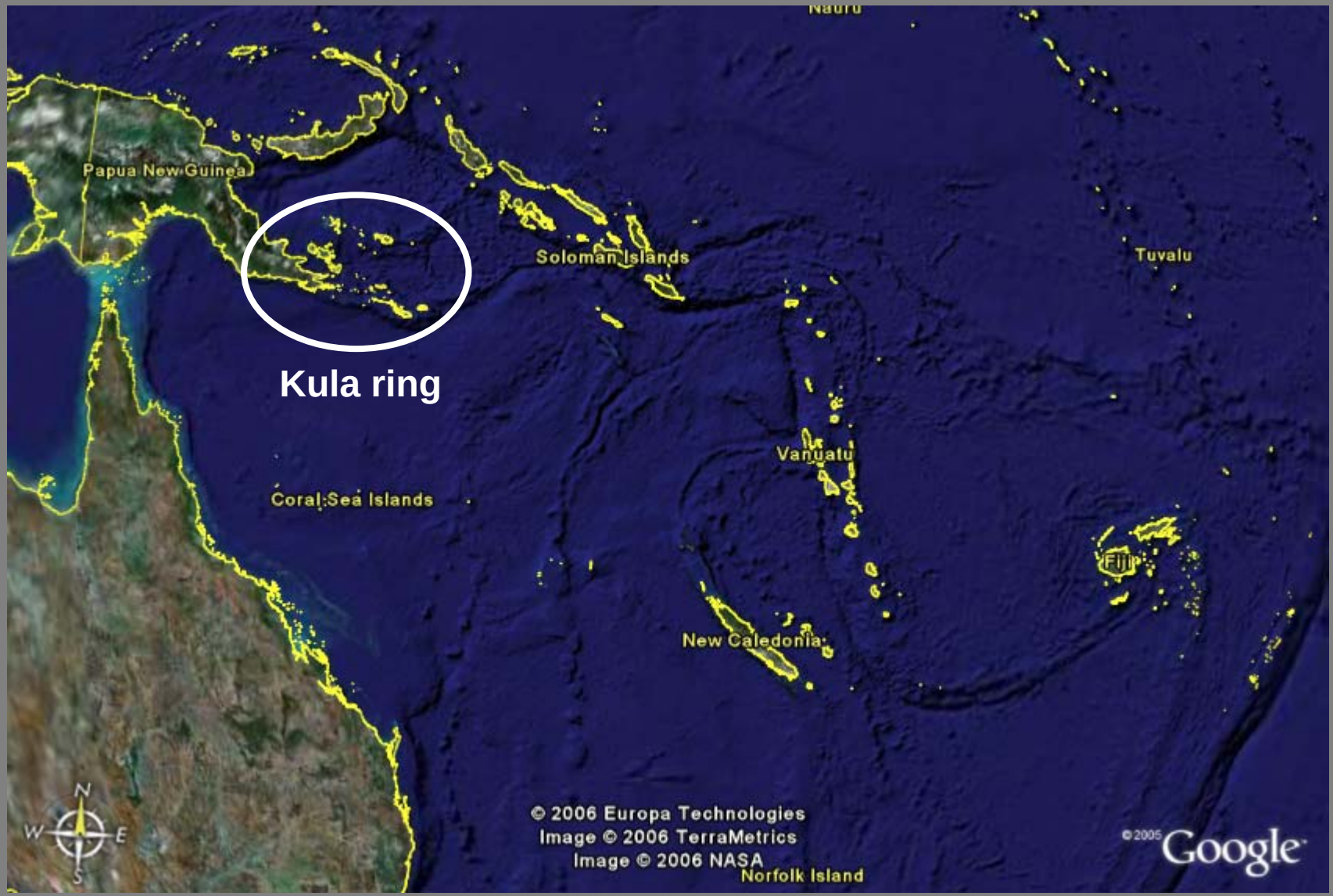
How is the physical archipelago linked to the human one?

History of analysis of archipelagos
(good heuristically – heterogeneous landscape)

Malinowski 1922 – *Argonauts of the Western Pacific*

The Kula ring

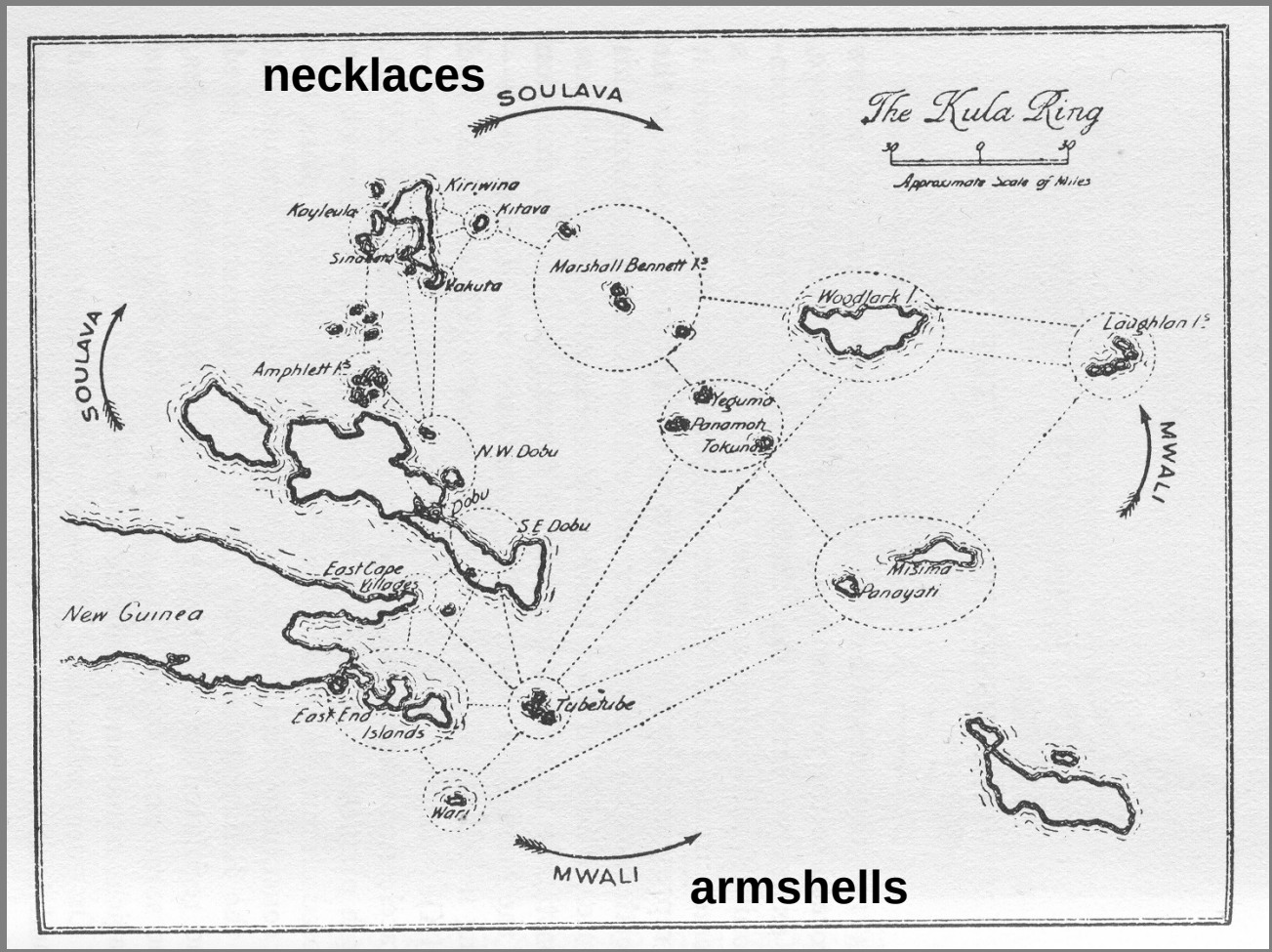




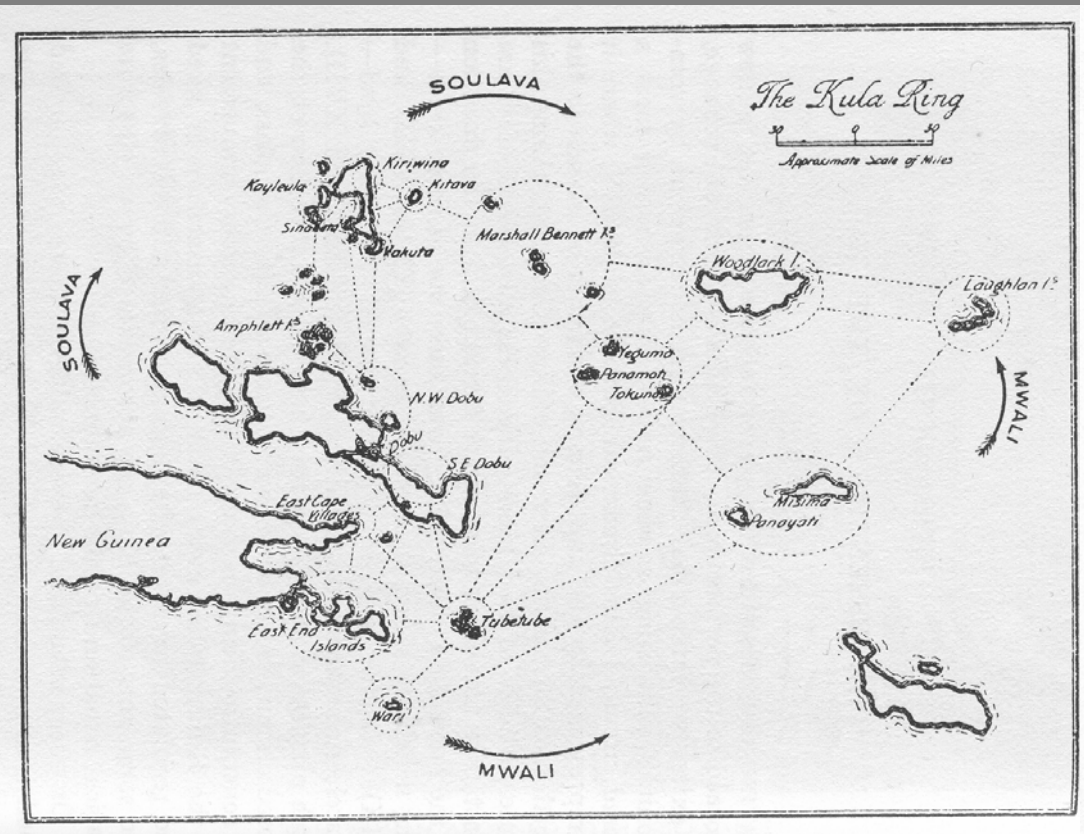
Scale – roughly that of the Mediterranean

Scale roughly that of the Aegean

From Malinowski 1922 *Argonauts of the Western Pacific*



Kiriwana in a ‘precarious’ position – can be bypassed in flow of valuables from 1 to 7



The Kula Ring (Malinowski)

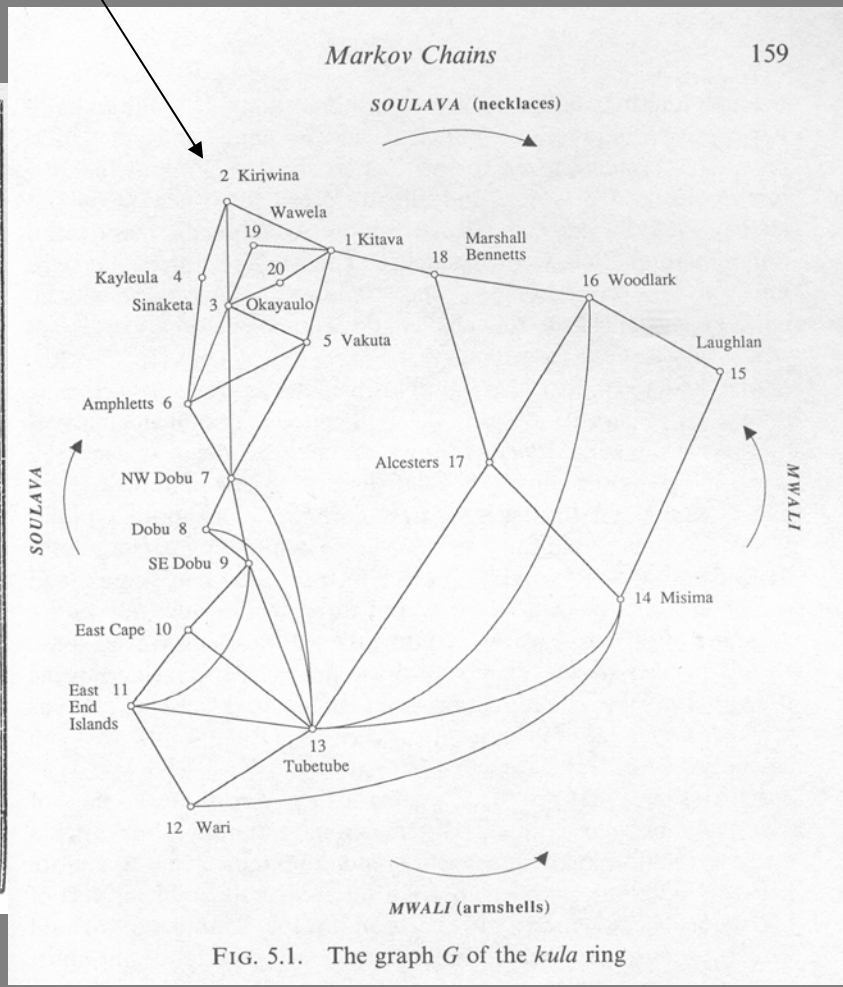


FIG. 5.1. The graph *G* of the *kula* ring

Graph of the kula ring (edges = exchange relations

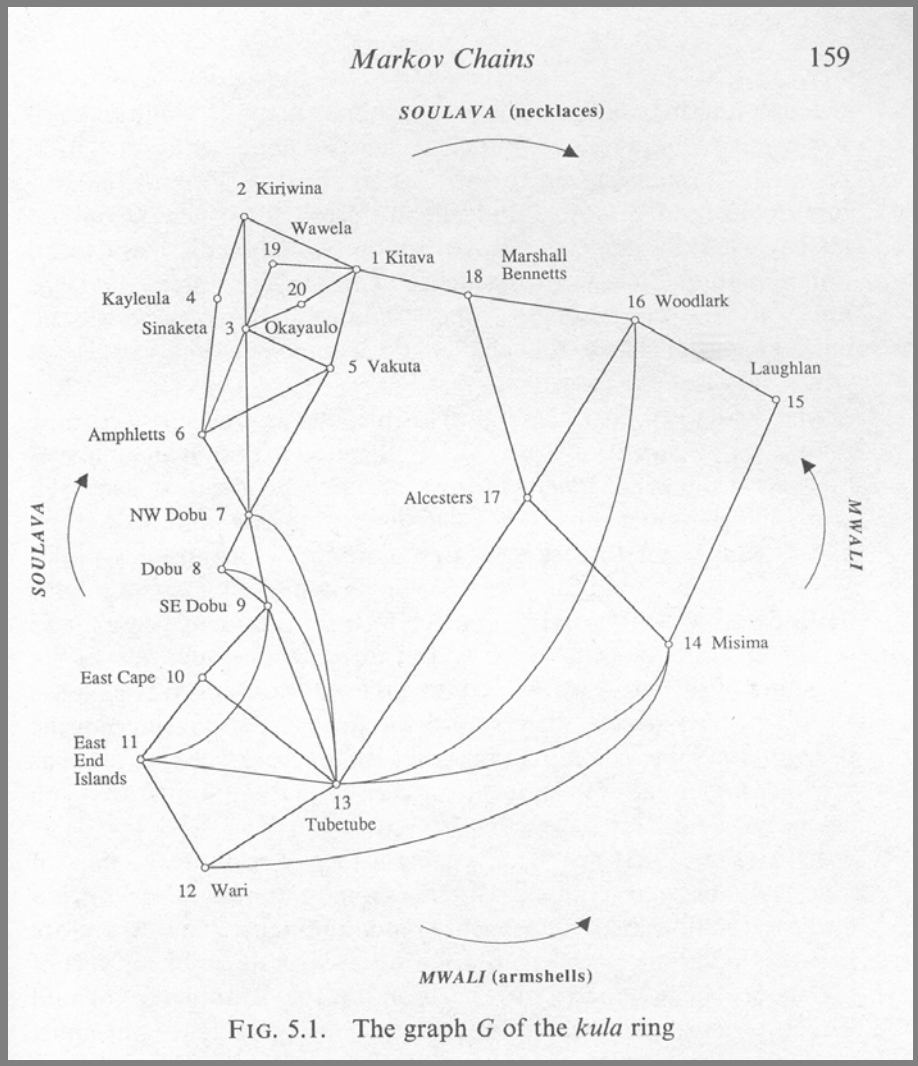


FIG. 5.1. The graph G of the *kula* ring

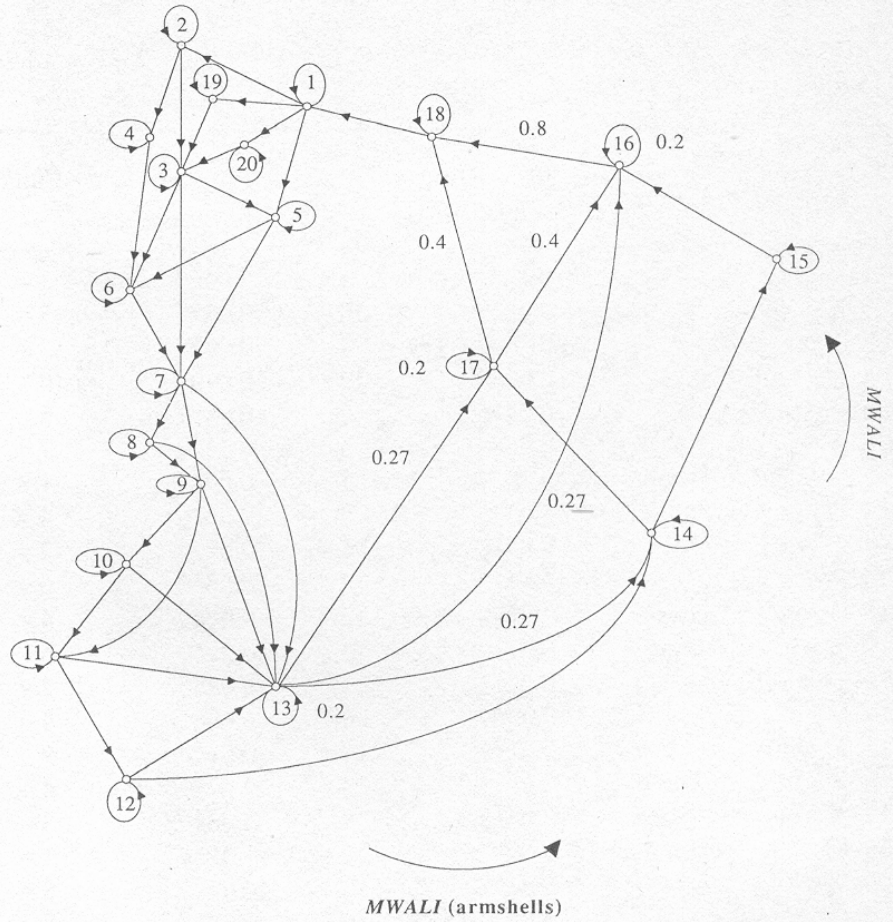
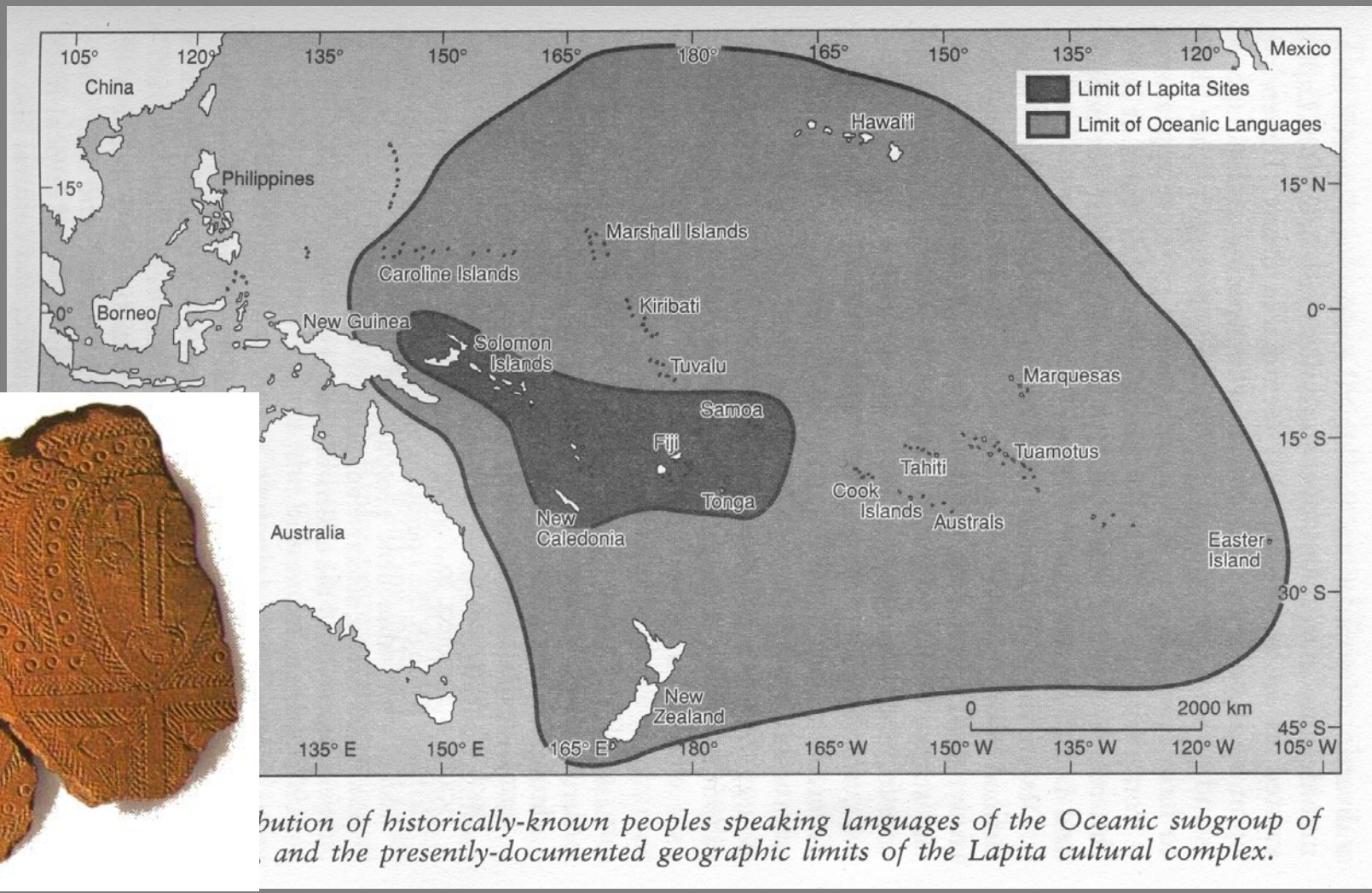


FIG. 5.3. A network N of the flow of *kula* valuables (armshells)

Hage and Harary (1991) Exchange in Oceania: a graph theoretic analysis

The Lapita Peoples (Kirch 1997) … a ‘super community’



bution of historically-known peoples speaking languages of the Oceanic subgroup of and the presently-documented geographic limits of the Lapita cultural complex.

Irwin 1992, 33: “nowhere in the world has the settlement of so vast an area been identified with such a clear archaeological signature as Lapita, and the situation promises new insights into the nature of human territorial expansion”

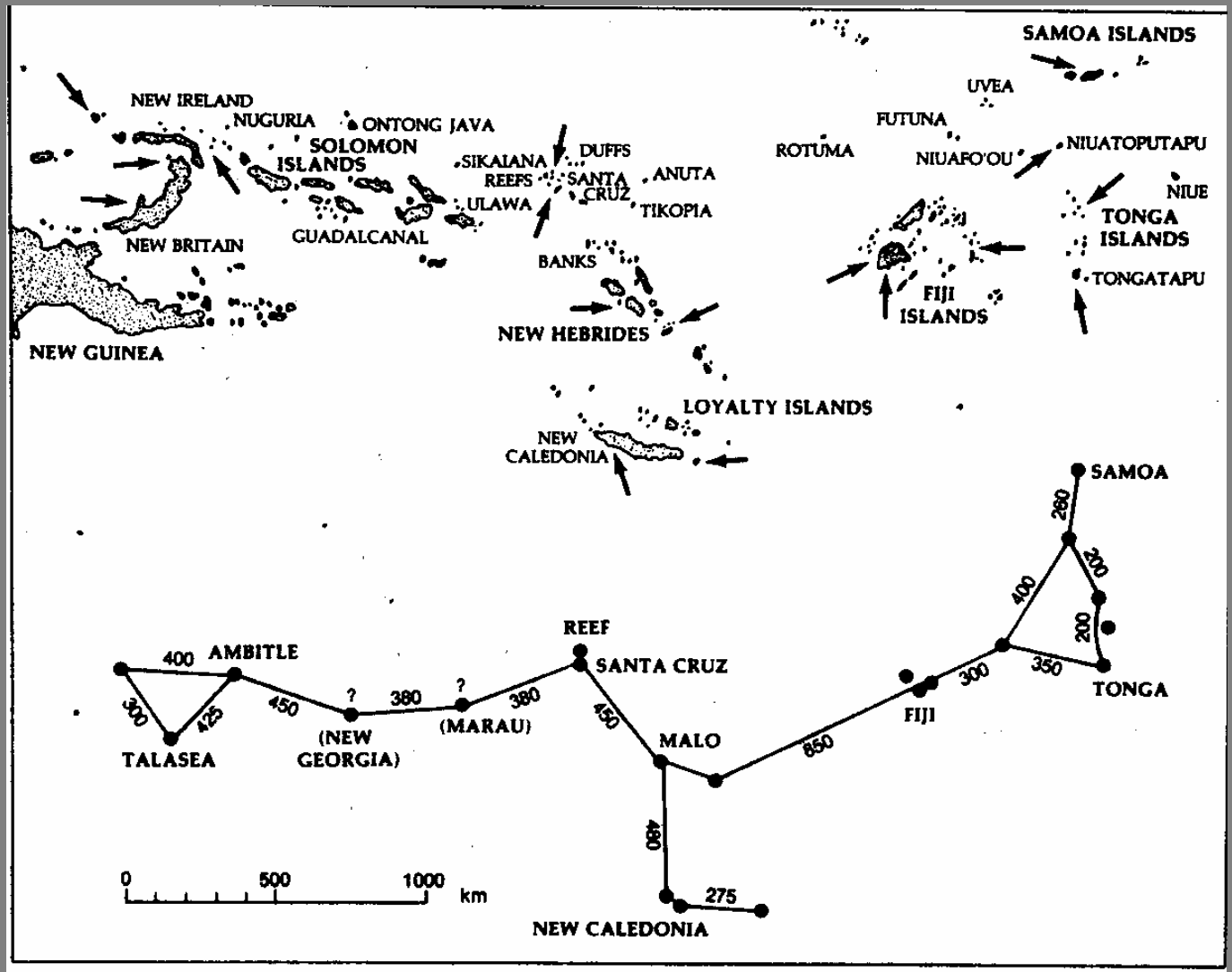
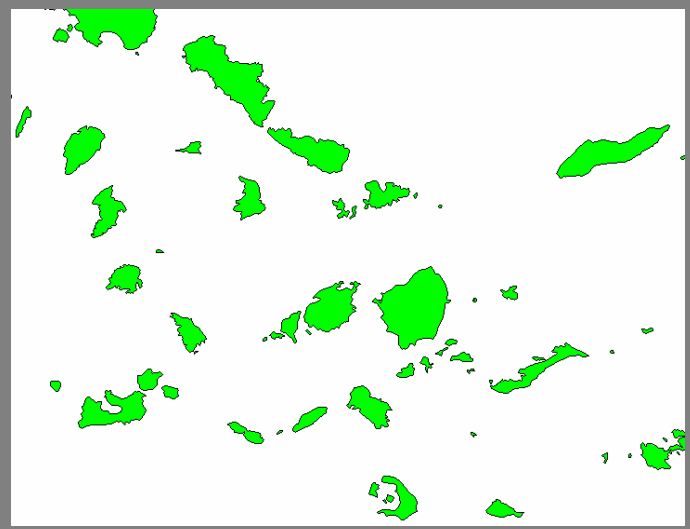


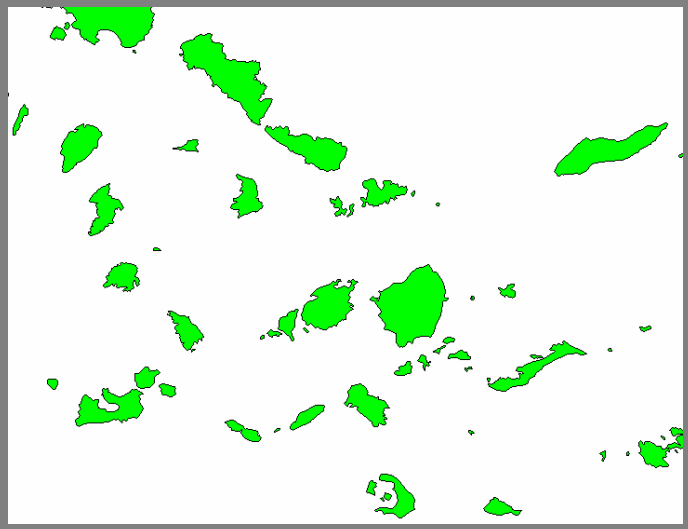
FIG. 1.10. The 'Lapita voyaging network' (from R. C. Green, 1979)

The analysis of these patterns in Oceania using graph theory has inspired a similar approach in the Aegean…

Broodbank has effectively treated the Cyclades as a socio-physical system for the Early Bronze Age

we discussed his work last year at ISCOM…





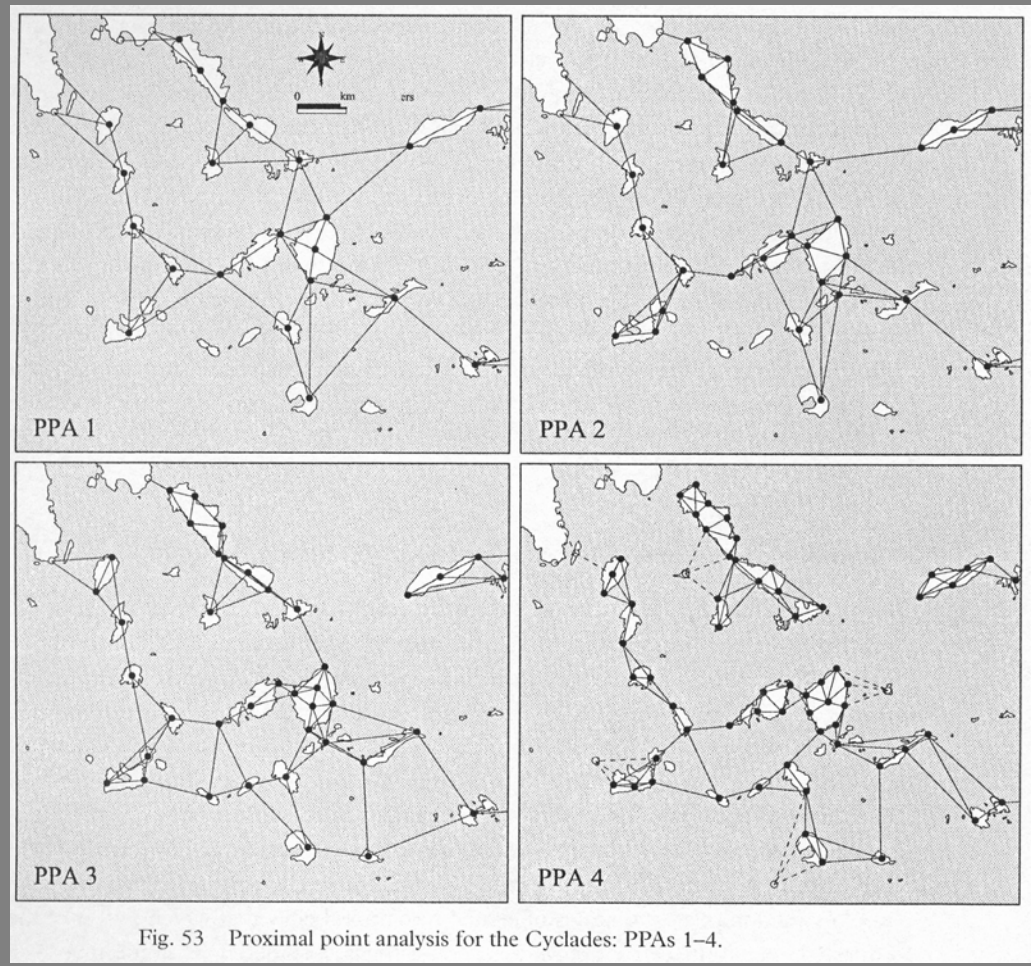


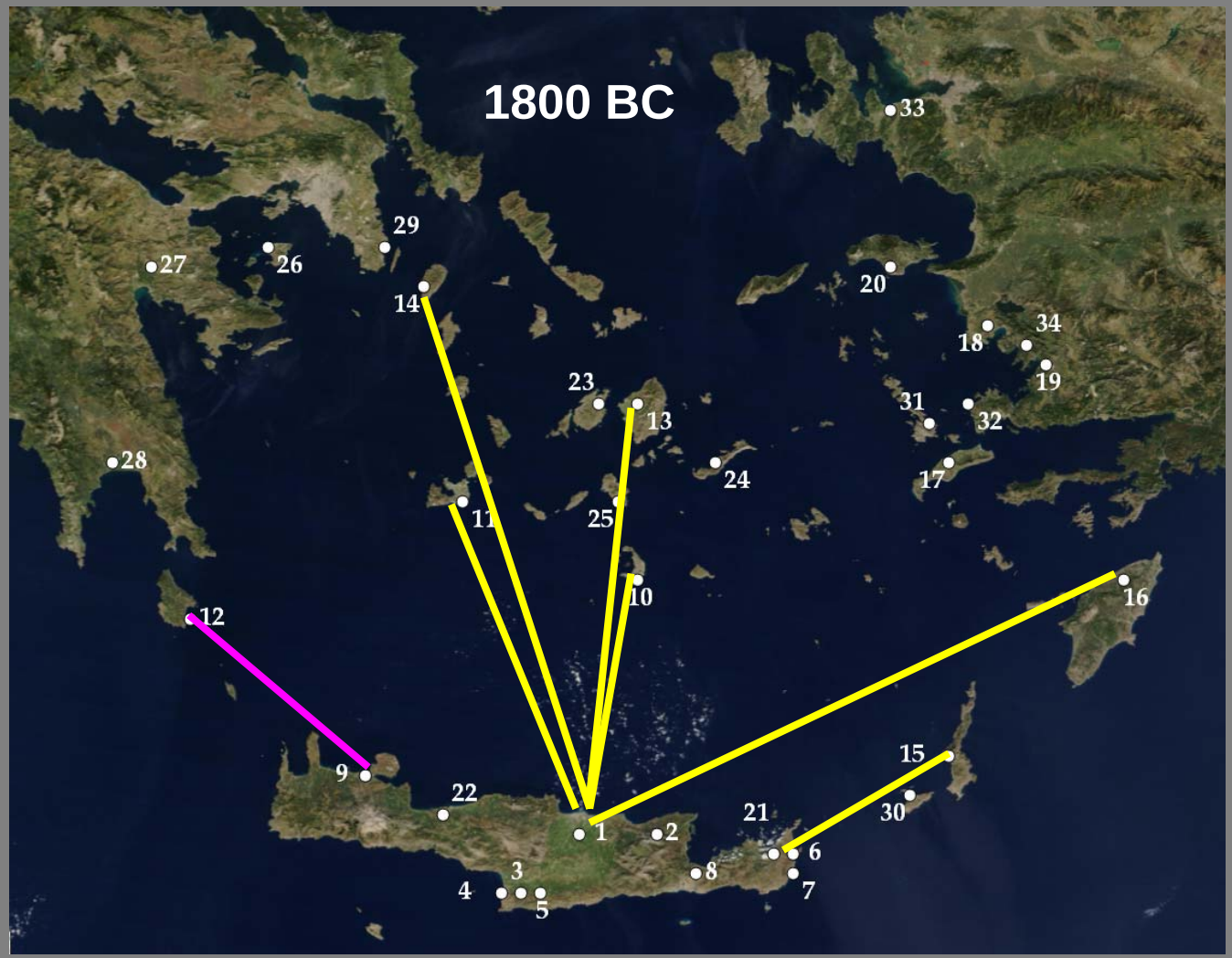
Fig. 53 Proximal point analysis for the Cyclades: PPAs 1–4.

In brief, Broodbank used PPA to understand centrality in the Cyclades

Aiming to explain settlement of marginal environments, such as Keros

- **So this is how we came to choose islandscapes**
- **However, we have different data and questions**

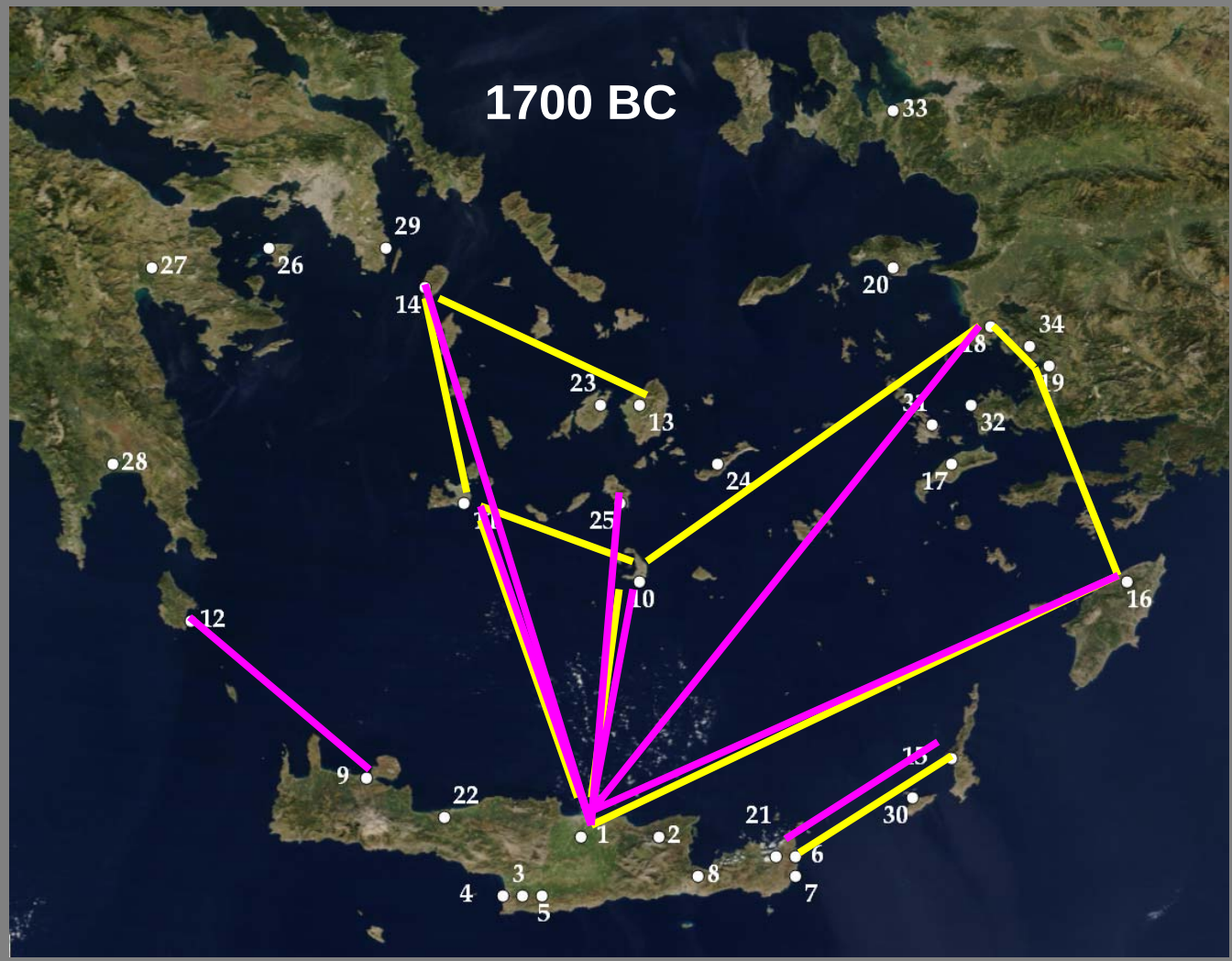
southern Aegean c. 1800-1700 BC
Let us look at two scenarios – first, c. 1800 BC
Crete has *contacts* off-island (and not '*colonies*', except one)
this is when it has 3 or 4 large palace sites on-island: *peer-polities*



= 'contact'

= 'colony'

southern Aegean c. 1700 BC
Scenario 2
Crete now has both contacts and colonies off-island; this is when it has one mega-centre: Knossos



= ‘contact’

= ‘colony’

Our questions:

- **what is the connection between macro-scale development of regional networks and emergence of primary centre?**

- **what can explain the variability in Cretan influence across the southern Aegean c. 1700 BC?**

Now over to Ray…

Concluding remarks

1. **Archaeological interpretation**
- changing network configuration with > mu
- relationship of site size to ‘importance’

2. **Socio-physical articulation**
- is there something about the physical configuration of this area that, when populated with sites in this way, is likely to create certain kinds of macro-level regularities from a very wide range of ‘social’ behaviours?
- or do we need to explore other kinds of behaviour (e.g. non-gravity models) to see if other regularities might emerge?
- What if we were to choose another territorial range, or choose points using different criteria?

3. Innovation
- regional networks = structures allowing innovation diffusion?
- OR are regional networks the innovation? If so, could we argue for the key role of artefacts in their elaboration and maintenance?