4 Sea Level at Troy in Finland

Stuart L. Harris, November 2011

Summary of Sea Level at Troy in Finland

Essential to understanding Troy in Finland is knowledge of relative sea level versus time.

During the last ice age, an ice cap over Finland sank much of the country below sea level, especially in the south. As the ice cap melted, islands emerged from the sea. The rate of uplift generally exceeded the rising sea, so that once land emerged, it remained dry. To facilitate transportation, Finns tended to build new homes as close to the sea as possible, but no closer than three fathoms (18 feet) above sea level to avoid damage from occasional tsunamis.

This rule of thumb provides a means to estimate the age of a building. First determine its elevation at the lowest point, subtract three fathoms, then look up the date from a curve of relative sea level versus time (Figures 1, 2). Thus by merely examining a building on a topographic map, its age can be estimated. This paper describes how relative sea level at Troy was obtained by combining sparse local data with detailed Florida data.

Figure 1: Relative sea level at Perniö near Troija from 6500 BC to 2000 AD.

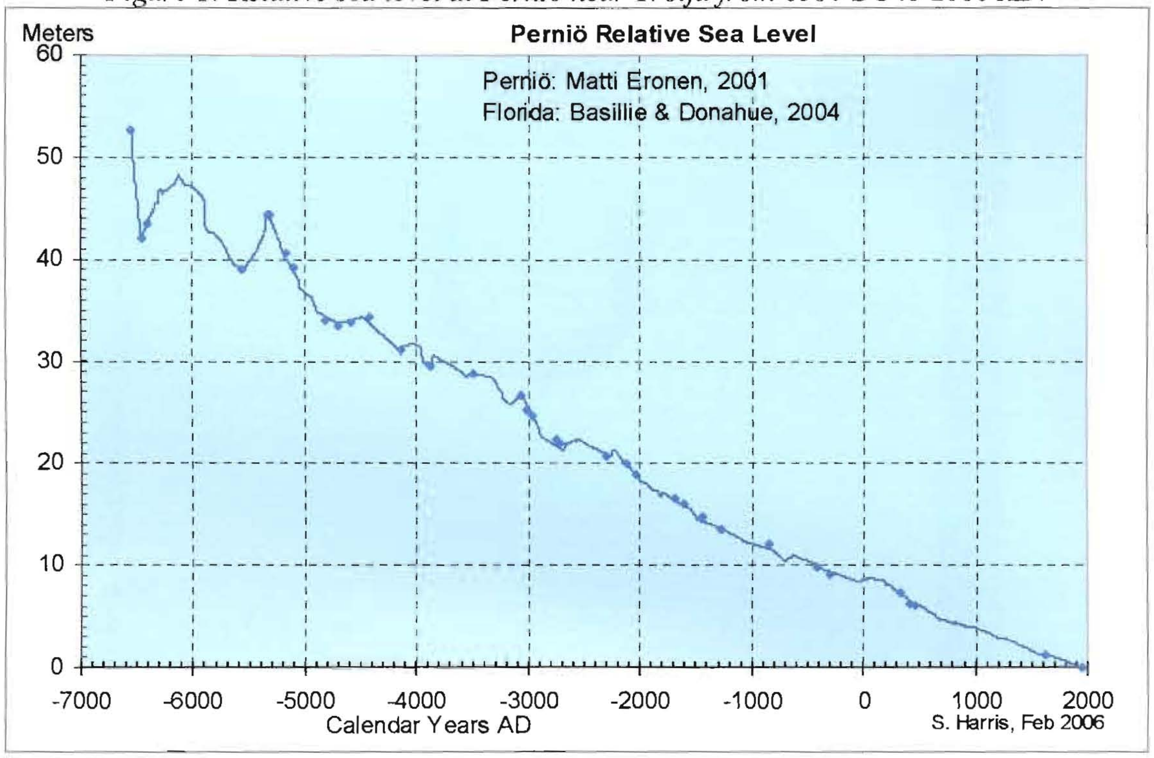
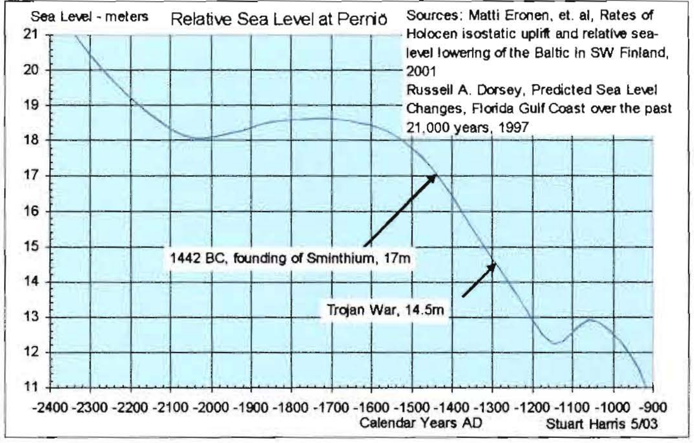


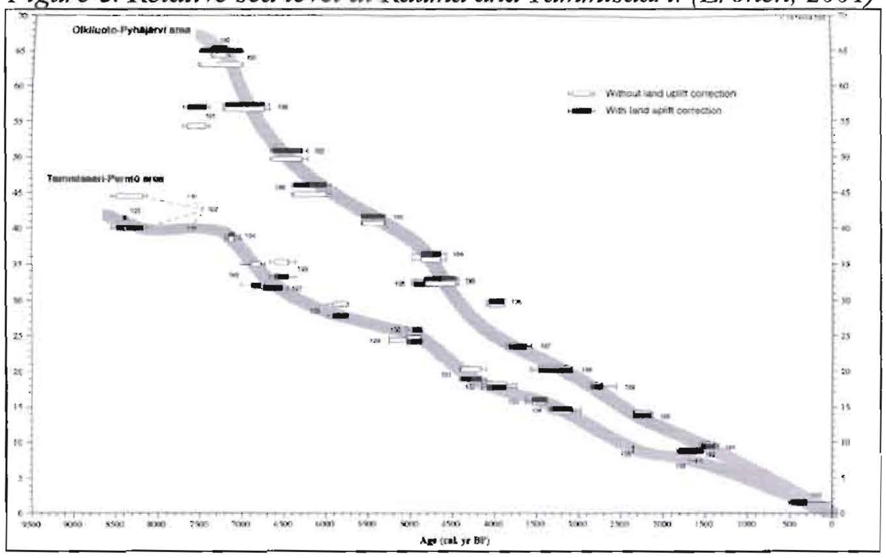
Figure 2: Relative sea level at Perniö from 2400 BC to 900 BC.



Matti Eronen: relative sea level at Rauma and Tammisaari

In 2001, Matti Eronen et. al. published data on relative sea level at two locations that bracket Perniö near Troy: Rauma to the north and Tammisaari to the south[1]. They corrected for settling and and applied tree-ring correction factors to radiocarbon dates. The resulting two curves are precise in altitude but somewhat uncertain in time (Figure 3).

Figure 3. Relative sea level at Rauma and Tammisaari. (Eronen, 2001)



Uplift in southern Finland can be modeled as a rigid plate that rotates around a hinge in the open sea between Finland and Estonia (Figure 4). Thus the two curves above should ratio exactly, with Perniö between them. To a first approximation, Perniö changes about 5% more than Tammisaari, and about 68% of the amount at Rauma.

[1] Eronen, Matti; Glückert, Gunnar; Hatakka, Lassi; Van de Plassche, Orson; Van der Plicht, Johannes; Rantala, Pasi; Rates of Holocene isostatic uplift and relative sea level lowering of the Baltic in SW Finland based on studies of isolation contacts, 2001, Boreas, V30, pp17-30, Oslo. Matti.Eronen@helsinki.fi

Figure 4: The two regions pivot on a hinge to the south, with Perniö in between.

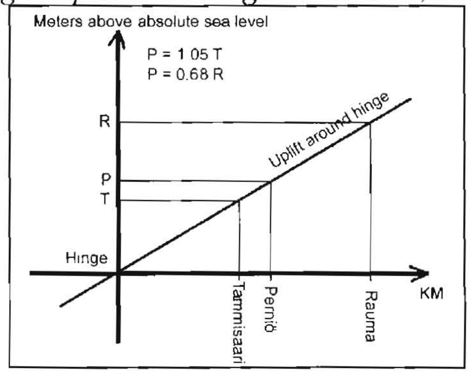
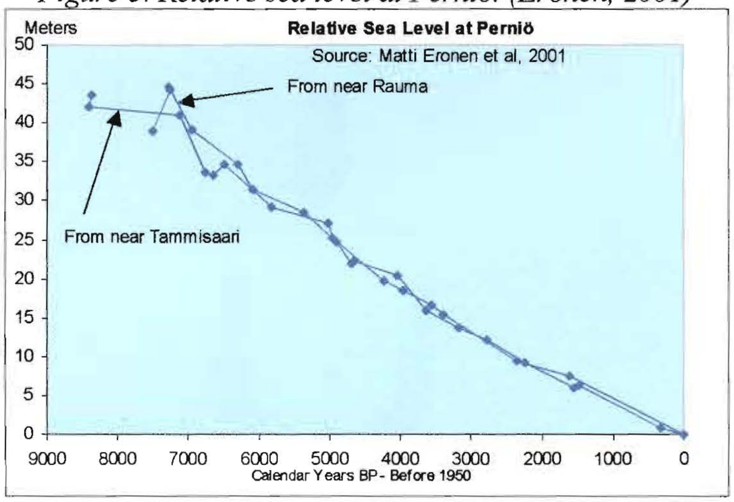


Figure 5 merges the two sets of data. The general trend is clear, but there are significant deviations. The problem now becomes how to obtain a smooth curve of glacial rebound by adjusting for changes in absolute sea level.

Figure 5. Relative sea level at Perniö. (Eronen, 2001)



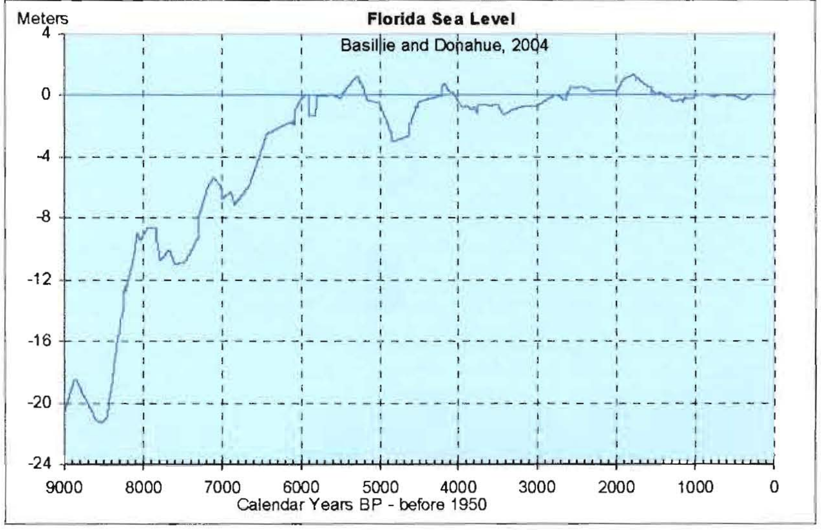
Russel Dorsey: absolute sea level on the gulf coast of Florida

In 1997, the late Russell A. Dorsey of Florida State University published a curve of absolute sea level in Florida[2], chosen because it was relatively unaffected by ice-age glaciers. In 2004 Basillie and Donahue updated Dorsey's estimate by using a seven-point average of more than a score of different surveys[3]. The resulting curve has abrupt transitions (Figure 6).

[2] Dorsey, Russell A.; Predicted sea level changes, Florida gulf coast over the past 21,000 years; 1997; GARI Research Series Number 9, Lecanto, Florida.

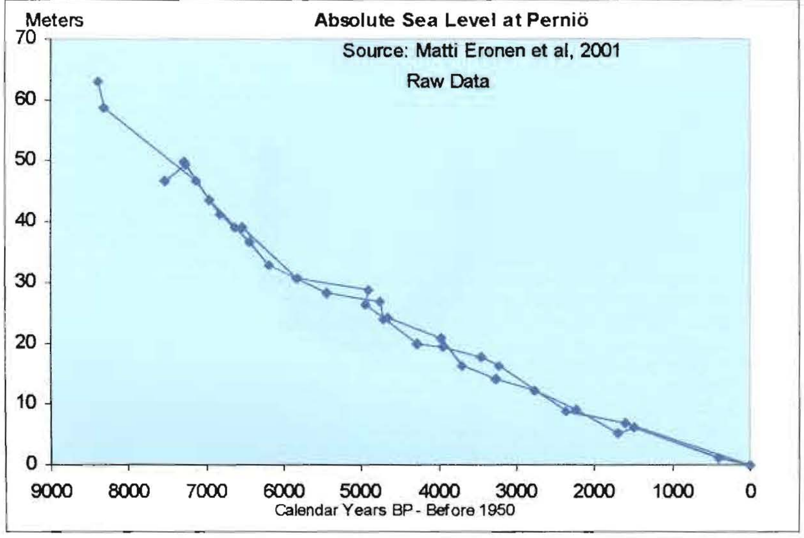
[3] Balsillie, James H. (FGS) and Donoghue, Joseph F. (FSU Department of Geological Sciences); "High Resolution Sea-Level History for the Gulf of Mexico Since the Last Glacial Maximum"; FGS Report of Investigations No. 103, 2004 Jim.Balsillie@dep.state.fl.us

Figure 6: Florida sea level, 0-9000 BP. (Basilie and Donahue, 2004)



To get an approximate measure of land uplift, subtract Florida absolute sea level from Perniö relative sea level (Figure 7).

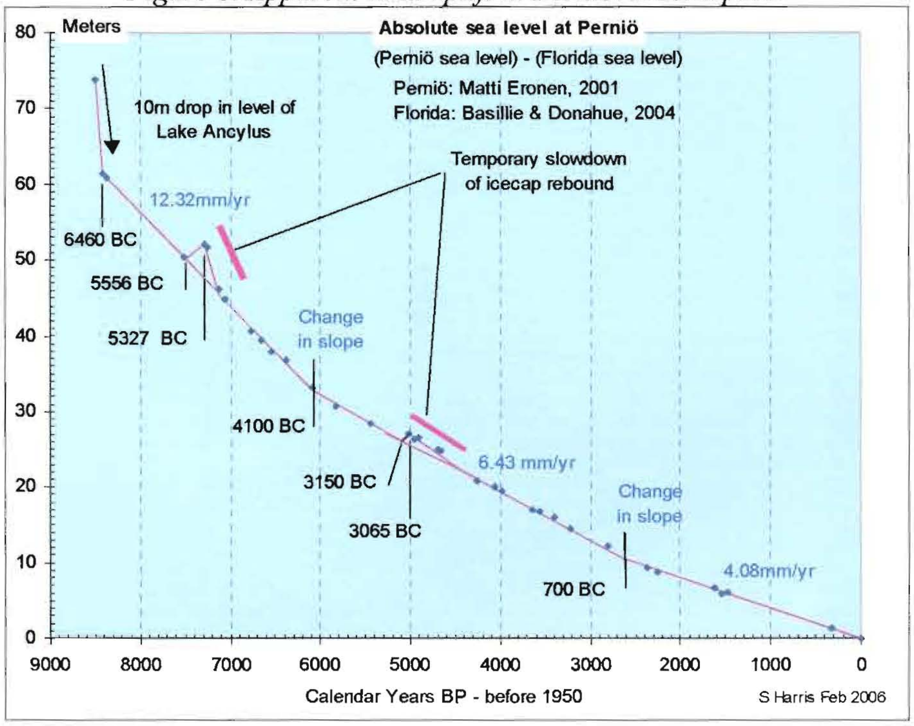
Figure 7: Apparent land uplift at Perniö = relative sea level - absolute sea level.



Next, within the error bounds of the data, modify both dates and elevations to bring the two curves closer together (Figure 8). Magically, the two curves become congruent!

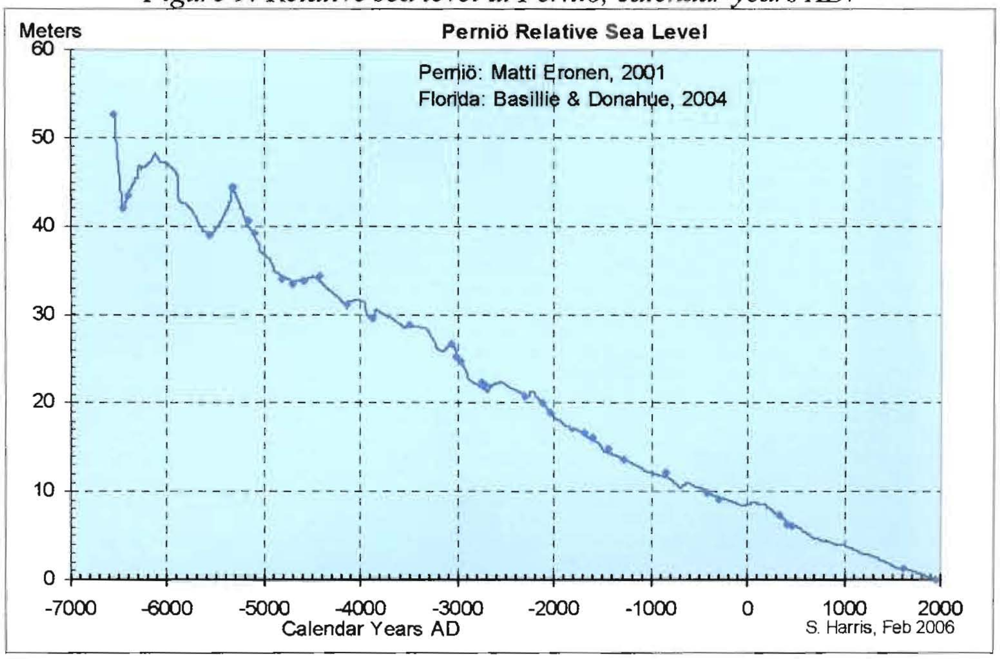
From this curve, land uplift has been more or less regular and continuous since the draining of Lake Ancylus around 6500 BC. There were three constant rates of rebound, with sharp transitions between them: 12.32 mm/yr from 6460 BC to 4100 BC, 6.43 mm/yr from 4100 BC to 700 BC, and 4.08 mm/yr since then. Around 5327 BC, Lake Ancylus momentarily returned and raised sea level by 5 m. Around 3150 BC, rebound appeared to slow down, then returned to its previous rate.

Figure 8. Apparent land uplift at Perniö. second pass.



Now to this smooth curve of glacial rebound add the jagged curve of absolute sea level from Florida to obtain relative sea level at Perniö.

Figure 9: Relative sea level at Perniö, calendar years AD.



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