The 2004 Indian Ocean tsunami has resulted in a marked increase in concern regarding regions not previously considered at high risk of tsunami inundation. The southeast coast of Australia is an excellent example; having a historical record suggestive of low tsunami risk, an extremely vulnerable coastline due to population concentration within the coastal zone and continuing controversy regarding the occurrence of megatsunami purported to be many times larger than the 2004 Indian Ocean event. This megatsunami research has subsequently been used to underpin palaeotsunami identification around the world through a unique set of diagnostic criteria. A re-examination of this work has led to research at four back-beach locations on the south coast of New South Wales, located close to sites reported to contain evidence of megatsunami inundation. Analysis of stratigraphy, sediments and microfossils within an extensive radiocarbon chronology at these sites reveals a markedly different coastal palaeo-environment during the Holocene. This highlights the importance of using multi-proxy diagnostic techniques in investigating potential tsunami inundation sites with relatively short historical records. Furthermore, this suggests an urgent need for reconsideration of a number of palaeotsunami indicators.