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Architecture and controls of thick, intensely bioturbated, storm-influenced shallow-marine successions

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Thick (¿100 m), highly bioturbated storm-influenced shallow-marine deposits are not common in the stratigraphic record, but some examples have been described in aggradational to retrogradational successions. In these, individual event beds have typically low preservation potential, yet shoreface-offshore depositional settings are still largely characterized based on the inferred frequency or magnitude of storms. Here we present a sedimentological study of a thick, bioturbated exhumed succession deposited during the early post-rift phase of the Neuquen Basin (Argentina). We characterize it and compare its stratigraphic record with examples elsewhere, in order to discuss the potential factors controlling the total overprint of storm-event beds during several million years. In the study area, the Bardas Blancas Formation (170-220 m thick) is dominated by muddy sandstones and sandy mudstones, and it also includes subordinate clean sandstones and pure mudstones. These stack to form different facies associations of a storm-influenced shoreface-offshore system. The offshore transition and proximal offshore strata invariably comprise intensely bioturbated deposits, with only a few preserved HCS-sandstone beds. The succession shows for most of its thickness a long-term aggradational pattern spanning 7-10 Myr and is associated with low riverine influence. By combining the observations and interpretations of the Bardas Blancas Formation with other subsurface and exhumed intensely bioturbated, shallow-marine successions, we dispute the general assumption that these are associated with low frequency or low magnitude of storms. Alternatively, we argue that the long-term efficiency of benthic fauna to overprint most of the storm-event beds that reached the offshore-transition sector, results from the combination of several factors: deposition in relatively confined marine depocentres, persistent low riverine influence, and long-term aggradational stacking pattern. As these conditions can develop in a variety of basin styles, such as rift, early post-rift, and foreland settings, the recognition of thick, bioturbated successions can be used to infer more realistic constrains for depositional models and better predict facies distribution in such storm-influenced systems.