Log jams caused braided-channel abandonment and avulsion in the Pennsylvanian South Bar Formation, Sydney Basin, Nova Scotia

M.R. Gibling[1], A.R. Bashforth[1], and H.J. Falcon-Lang[2]
1. Department of Earth Sciences, Dalhousie University, Halifax, NS, Canada B3H 3J5 <mgibling@dal.ca>¶ 2. Department of Earth Sciences, Royal Holloway, University of London, Egham, Surrey, United Kingdom TW20 0EX

Log jams are a major cause of modern channel blockage, and frequently trigger abandonment of the whole channel belt (avulsion). Prior to the advent of abundant, large trees late in the Devonian, log-jam triggering was not possible. Only one ancient log jam — in an Early Pennsylvanian (Langsettian) channel fill — has been well documented to date. We document here, numerous log jams from excellent exposures of the Middle Pennsylvanian South Bar Formation (Bolsovian to Asturian) along Sydney Harbour.

The South Bar Formation comprises thick braided-fluvial sandstones and conglomerates with sparse shales, discontinuous coals, and coal fragments (former peat mats). At the top

Atlantic Geology, 2009, Volume 45, Number 1

of many sandy channel fills, stacked logs, and peat mats in a matrix of sand, gravel, and mudstone fragments are overlain by shales laid down in abandoned channels. The organic accumulations are up to 2.5 m thick, and individual logs are up to 2 m long and 0.8 m wide, with peat mats up to 3.5 m long and 0.12 m thick. The logs are flattened and the organic beds must have been much thicker prior to compaction and coalification — probably approaching the depth of some braid channels (~3–8 m). Although log orientation is variable, many logs lie normal to paleoflow as in modern log jams. Where sandstone/shale contacts lack log jams, the sandstones include sigmoidal trough cross-beds, plane beds, and antidune bedforms, suggesting that the channels were choked with sediment brought down by high-energy floods.

Plant axes in the log jams comprise a wide variety of taxa, but poor preservation resulting from entrainment in high-energy flows means that most cannot be identified. Nonetheless, members of the five main Carboniferous plant groups are represented, including the lycopsids (*Sigillaria, Lepidodendron*), sphenopsids (*Calamites*), tree ferns, pteridosperms, and cordaitaleans. Most probably grew on inactive braided tracts adjacent to the active channels, rather than on distant uplands. The close association between peat mats and logs suggests that forested peat mires on the floodplain were undercut during major floods, yielding large volumes of woody material.

We conclude that late Pennsylvanian braided-river plains were sufficiently forested to behave very like modern river plains where log jams commonly trigger intrinsic channel changes. High-magnitude floods eroded vegetated banks and floodplains, toppled trees, and destroyed peats and mud layers. The resulting accumulation of thick layers of organic material and flood sediment caused channel blockage and abandonment. Although flow may have relocated within multi-channel tracts, a radical paleoflow change above one log jam suggests that the entire channel belt avulsed.