Davies et al. (2010, abstract) propose that, contrary to past studies, “The evidence suggests that the Juniata Formation at Potters Mills was deposited in a marginal marine setting and, as such, no evidence for early life on land can be inferred from its strata.” The new evidence they present, not only from the Juniata Formation at Potters Mills, but from other localities in Pennsylvania, is a facies analysis and description of sedimentary structures. This is a welcome approach to the problem, because there are distinctive marine sedimentary structures and facies such as turbidites, hummocky cross-bedding, and flaser and lenticular bedding. However, this promising approach failed because neither these nor any diagnostic marine sedimentary structure is described from the Juniata Formation by these or prior authors. The sole plausible exception is a single case of reversing cross stratification at Waggoners Gap, which is inadequately exposed and qualified by Davies et al. (2010) as a possible artifact of outcrop orientation. The sedimentary structures and facies of the Juniata Formation have long been interpreted as formed in braided streams (Cotter, 1978), thus explaining the lack of lateral accretion deposits formed by meandering streams.

“Under other circumstances, particularly given the nondiagnostic nature of the sedimentary facies, it would be standard practice to assume significant marine influence in the Juniata Formation based on the diverse and abundant trace fossils,” write Davies et al. (2010, p. 535), although they make an exception for repichnia (surface tracks and trails). “The lack of evidence for repichnial trackways in the Juniata sets it apart from all other early Paleozoic, terrestrial trace fossil-bearing successions described to date” (Davies et al., 2010, p. 535). This statement is directly contradicted by their own illustrations of such fossils from the Juniata Formation (Davies et al., 2010, fig. 5N) labeled as “repichnial crossing trails on base of sandstone.” Davies et al. (2010) also failed to note other trackways from the Juniata Formation recorded by Diecchio and Hall (1998). Terrestrial arthropod trackways of Ordovician and Cambrian age were initially controversial, but are now accepted (Retallack, 2009a; Collette et al., 2010). So the argument for marine paleoenvironment comes down to non-repichnial trace fossils of the Juniata Formation, presented by Davies et al. (2010) in an unsystematic account, and illustrated with field photographs of indeterminate specimens. For example, “U-shaped burrows” are inferred from converging but unconnected burrows (“apparent U-shaped lined burrow”) Davies et al., 2010, caption to fig. 5D) and from “aperture pairing” seen on surfaces only (“exposures of burrow tops appear to exhibit aperture pairing (Fig. 5L), potentially indicative of U-shaped burrows.” Davies et al., 2010, p. 534). Only eight ichnogenera are known from the Juniata Formation (cf. Diplichnites, Circulichnus, Helminthopsis?, Palaeophycus, Planolites, Scolicid?, Scoyenia, Skolithos; Retallack, 1985, 2001; Diecchio and Hall, 1998; Davies et al., 2010) and comparable forms are found elsewhere in Cambrian–Ordovician fluvial and lacustrine rocks (Trewin and McNamara, 1994; Mikuláš, 1995; Retallack, 2008, 2009a, 2009b). The Juniata Formation has not yet yielded such traces as Rauophycus or Chondrites, common among at least 22 ichnogenera in Ordovician (Katian) marine rocks around Cincinnati, Ohio, United States (Osgood, 1970).

The particular burrows disputed by Davies et al. (2010, p. 536) at Potters Mills are within paleosols recognized from a variety of lines of evidence. The micritic replacive nodules at Potters Mills can be seen in field and thin section to both predate and postdate the burrows, and have light isotopic values (δ13Ccalcite = −4.1%o to −6.93%o) as found only in soils and paleosols (Retallack, 2001). Marine carbonate isotopic compositions are close to zero by definition, and approach mantle values (δ13C of −5%o) only with complete global cessation of photosynthesis (Hoffman and Schrag, 2001). The paleosols at Potters Mills have soil structures (peds and cutans) and microstructures (sepic plasmic fabric) unknown in marine strata (Retallack, 1997). Hydrolytic weathering (loss of alkali and alkaline earth bases) documented within these thin paleosol profiles is the opposite of marine hydromorphism, which restores bases to clays (Feakes and Retallack, 1988). None of these three lines of evidence are mentioned or disputed by Davies et al. (2010, p. 535), who mistakenly regard the paleosols as weakly developed despite their own illustrations (Davies et al., 2010, fig. 4C) of large caliche nodules (moderately developed by definition: Retallack, 1997). These paleosols cannot have formed in the intertidal zone as suggested by Davies et al. (2010, p. 536) because caliche requires an extended season of dry soil (Retallack, 1997). Nodules in intertidal to estuarine soils and paleosols are pyritic in fully marine salinities, and phosphatic or sideritic in brackish tidally perched waters, as demonstrated for paleosols at the transition between the Juniata Formation and overlying Clinch Sandstone in Tennessee by Driese and Foreman (1992).

Davies et al. (2010, p. 536) are also mistaken in assuming that there were no myriapods older than Silurian. The early Cambrian Pseudoiulia cambriensis (Hou and Bergström, 1998), middle Cambrian Cambropodus gracilis (Robison, 1990), and late Cambrian Xanthomyria spinosa (Budd et al., 2001) are problematic mainly because they are incomplete and exceptionally rare in marine shale. These beautifully articulated remains are similar in all preserved features to iodid millipedes, scutigeromorph centipedes, and archipolypodan millipedes, respectively. Even if these fossils could be shown to be phylogenetically independent of myriapods, morphologic convergence evolves for common function, and convergence of Pseudoiulia with burrowing millipedes is striking. Wilson (2006) and Shear and Edgecombe (2010) confirm trackways from the Lake District of England as evidence of Middle Ordovician (Darriwilian) myriapods, though of a type (Polynexid or Arthropleurida) unlikely to have made the Potters Mills burrows. Other Cambrian and Ordovician subaerial trackways are attributed to creatures other than myriapods, especially euthycarcinoids (Retallack, 2009a; Collette et al., 2010).

Davies et al. (2010, p. 528) are correct that the maker of the Potters Mills burrows, like many trace makers, remains hypothetical. An animal with growth instars, elliptical cross section, and bilateral symmetry made the burrows in very dry soils, and also left elliptoidal feces with diameter 20%–25% of burrow diameter and ferruginized linings. This suggests a