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Finding tectonic signals from ancient volcano-sedimentary successions: an example from the Miocene Janggi Basin, SE Korean Peninsula

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In extensional and transtensional basins, the dual action of basin-forming tectonism and explosive volcanic activity results in deposition of complex volcano-sedimentary successions. Since both aspects contemporaneously affect sediment-dispersal systems, it is difficult to distinguish one from the other by analyzing volcano-sedimentary successions. To discriminate tectonic influence, basin fills of the Miocene, pull-apart Janggi Basin were investigated. Here, the contemporaneous influence of tectonic subsidence and explosive volcanism formed <966 m thick, conformable volcano-sedimentary successions composed of laterally extensive, pumice-bearing, unwelded pyroclastic deposits and nonmarine sedimentary rocks formed under humid climatic conditions. Based on Laser Ablation – Multiple Collector – Inductively Coupled Plasma Mass Spectrometry zircon U-Pb age data, these successions were deposited from 21.1 ± 0.2 to 20.1 ± 0.1 Ma. After deposition of basinwide, tens of metres thick, and unwelded pyroclastic deposits, the directly overlying facies successions (FS-1 and FS-2) show contrasting depositional features to the classical model of volcaniclastic sedimentation. Facies succession-1 is represented by fluvial conglomerates composed mostly of (sub)rounded pebble and cobble sourced from basement. The supply of basement-derived clasts through fluvial systems resulted from development of physiographic relief during or soon after the eruption by syndepositional tectonic subsidence. Facies succession-2 occurs directly on pyroclastic deposits that cover FS-1 and show coarsening-upward trends, and is composed of basal lacustrine mudstones and overlying resedimented volcaniclastic sandstones showing a progradational geometry, interpreted as a result of progressive filling of the lake by remobilized volcaniclastic sediments. Occurrence of basal lacustrine laminated mudstones indicates that syndepositional creation of the accommodation by tectonic subsidence exceeded forceful input of pyroclastic and remobilized volcaniclastic sediments, resulting in a delayed sedimentary response to explosive volcanic eruptions. This study shows that, despite voluminous production of volcaniclastic sediments, tectonic activity controlled sediment type and stacking patterns. Therefore, these depositional features allow to discriminate tectonic effects from complex volcano-sedimentary successions, enabling to reconstruct basin evolution.