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From Model to Outcrop: Applying Sandstone Uranium Concepts to Basin Margin Discovery

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Sandstone-hosted uranium deposits, particularly roll-front systems, account for significant production across the U.S. from South Texas to the Wyoming Basins and remain central to U.S. uranium supply. These deposits are governed by fluvial architecture, basin evolution, redox interfaces, and source-terrain geochemistry.

This presentation reviews the fundamental controls on roll-front mineralization—including facies distribution, reductant development, oxidation–reduction boundaries, and basin-margin structural influences—using publicly available data and first-person field studies from the Powder River Basin and comparable uranium districts.

Building from and evolving the established deposit models, the talk demonstrates how predictive geological reasoning can be applied at the outcrop scale. Field observations along the Pine Ridge of Johnson County, Wyoming illustrate how fluvial sedimentary architecture, lithologic alteration patterns, and remnant uranium mineralization along the basin margin can signal down-dip migration of a roll-front system and the presence of a previously unrecognized mineralized body.

Based on personal field observations and studies, this case study highlights how disciplined deposit modeling—combined with careful field interpretation—remains a powerful tool for discovery in mature basins.