

# SemTrack: A Semantic Knowledge Graph Approach to Geological Information Integration

Imadeddine Laouici<sup>1</sup>

<sup>1</sup> French Geological Survey (BRGM)

The understanding of the subsurface relies on integrating heterogeneous geological information originating from geological maps, geological models, and textual sources such as reports and scientific publications. In current practice, these sources remain rarely homogenized and are reconciled manually by domain experts, mostly in the context of 3D geomodel construction projects. Even when information is reconciled, existing methods offer limited support for expert knowledge integration, traceability of interpretations, and automated wholistic consistency checking.

We propose SemTrack, an ontology-based integration approach designed to formalize, reconcile, and exploit multi-source geological information within a unified knowledge graph. In this framework, SemTrack integrates structured information extracted from maps and numerical geological models with unstructured knowledge derived from textual documents, all aligned through a dedicated modeling ontology. The resulting knowledge graph supports logical reasoning and knowledge inference using SWRL rules to ensure the consistency of geological constraints and allows to explicitly encode expert interpretations record. This enables the automation of conceptual inconsistencies detection, transparent inference of implicit geological relationships, the completion of missing information across multiple sources, and advanced complex querying of initially heterogenous geological information.