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Spatial Patterns and Temporal Trends in Geochemical Research Capacity in Turkey: A GIS-Based Assessment of Knowledge Infrastructure Resilience

MINA CETINER
GEBZE TECHNICAL UNIVERSITY

Building resilient and sustainable geochemical infrastructures requires not only advanced analytical facilities, but also a geographically balanced and thematically diversified knowledge production system. Despite the central role of geochemistry in energy transition, environmental sustainability and resource management, limited attention
has been paid to the spatial structuring of geochemical research capacity at the national scale.

This study presents a GIS-based assessment of geochemistry-related Master's and Doctoral theses completed in Turkey between 1984 and 2025, retrieved using the keyword “jeokimya” from the Turkish Higher Education Council (YÖK) National Thesis Database. A total of 888 theses were identified (670 MSc and 218 PhD). While the full dataset provides a historical overview of national research development, spatial and thematic analyses focus primarily on the post-2010 period, where institutional expansion and thematic diversification become more pronounced.

The theses were classified into six major thematic clusters, including energy-related geochemistry (e.g., geothermal and hydrogeochemistry), environmental geochemistry, ore and economic geochemistry, petrogeochemistry, isotope geochemistry and marine/biogeochemical studies. Each thesis was georeferenced according to its host university, enabling spatial clustering, institutional concentration and specialization analyses.

Preliminary findings indicate a strong concentration of geochemical research activity within a limited number of metropolitan research universities. While petrogeochemistry and ore-related studies remain historically dominant, geothermal and environmental geochemistry show noticeable growth over the past decade, reflecting global sustainability and energy-transition priorities. However, the uneven spatial distribution of research capacity
suggests structural asymmetries that may influence the long-term resilience of national geochemical knowledge systems.

By integrating spatial planning methodologies with geochemical research analytics, this study contributes to discussions on the spatial resilience of geochemical knowledge systems and on structural barriers to participation in Earth science research, drawing on evidence from Turkey as a national-scale case study.