# The Critical Role of Geoscience in EU Defence and Security Policy

**October 2025. A position paper on strengthening European strategic autonomy through geosciences expertise**

## 1. Executive Summary

In an era of heightened geopolitical tensions and evolving security challenges, geoscience has become indispensable to European Union defence and security policy. The implementation of the Critical Raw Materials Act (CRMA) represents a watershed moment in recognising the strategic importance of geoscience for European defence capabilities. This paper outlines how geoscientific expertise underpins critical defence functions and provides recommendations for strengthening the integration of geoscience into EU security policy frameworks.

Geoscientists contribute to defence policy through critical raw materials security, climate adaptation strategies, environmental monitoring, natural hazard preparedness, and technological innovation. The CRMA's ambitious targets—extracting 10% of strategic raw materials domestically, processing 40%, and recycling 25% by 2030—cannot be achieved without robust geoscientific capacity and expertise.

### Key Recommendations:

- Consider establishing a dedicated EU Geosciences for Defence Centre,
- Explore integration of geoscientific expertise into the European Defence Fund,
- Expand educational and training programmes in critical raw materials geology,
- Strengthen international cooperation on geological intelligence,
- Support development of comprehensive geological databases for strategic planning.

# 2. The Strategic Imperative

## 2.1. Critical Raw Materials and Defence Technologies

The European Union's defence capabilities depend fundamentally on access to critical raw materials (CRMs). Modern defence systems—from advanced fighter aircraft to missile guidance systems, satellite communications to cyber warfare infrastructure—require specialised materials with unique physical and chemical properties that only geoscientists can effectively locate, assess, and develop.

The CRMA identifies 34 critical raw materials, of which 17 are considered 'strategic raw materials' (SRMs) crucial for defence applications. These materials are integral components in everything from jet engines and communication satellites to missile guidance systems and advanced electronics. Without secure access to these materials, European defence technological superiority remains vulnerable to supply chain disruptions and geopolitical manipulation.

## 2.2. Supply Chain Vulnerabilities

The EU currently faces extreme dependencies on third countries for critical raw materials essential to defence. China controls 100% of rare earth element processing for permanent magnets, 97% of EU magnesium supply, and significant portions of other strategic raw materials. Recent export restrictions on gallium, germanium, graphite, and antimony have demonstrated how quickly these dependencies can be weaponised.

China's export controls have led to near-doubling of gallium prices in Europe and 52% increases in germanium prices, whilst antimony prices have reached record highs. These disruptions directly impact defence procurement costs and availability of essential components for military systems.

# 3. Contributions of Geoscience to EU Defence Policy

## 3.1. Critical Raw Materials Security and Strategic Autonomy

**Resource Assessment and Exploration.** Geoscientists locate and assess essential resources, ensuring that armed forces have timely access to the energy and materials necessary for defence technologies. The CRMA mandates that Member States develop national exploration programmes targeting CRMs, requiring extensive geological expertise to map domestic resources and assess extraction feasibility.

**Processing and Recycling Innovation.** Advanced extraction and processing technologies with transformative environmental performance enable development of lower-grade and complex deposits. Geoscientists are essential for developing innovative approaches to urban mining, waste reprocessing, and circular economy solutions that can reduce dependence on volatile international markets.

**Supply Chain Monitoring.** The CRMA establishes comprehensive monitoring systems for supply chain risks, requiring geoscientists to track trade flows, assess geological constraints on production,

and conduct stress tests for strategic raw materials. This intelligence function is crucial for early warning systems and strategic stockpile management. Notably, all national mineral observatories currently operating in the EU and the UK, mandated with such tasks, fall under the organisational structure of national geological survey organisations.

### 3.2. Climate Adaptation and Defence Infrastructure

**Infrastructure Resilience.** Climate change impacts are expected to complicate operational readiness and execution as altered weather patterns affect training, logistics, and force projection capabilities. European military installations face increasing risks from sea-level rise, extreme weather events, and changing precipitation patterns that require geological assessment and adaptation strategies.

**Operational Planning.** Geoscientists enhance national security by providing accurate weather, space weather, and geological hazard forecasts essential for planning and conducting military operations safely and effectively. From strategic deployment decisions to protecting critical satellite infrastructure, geological intelligence supports operational effectiveness.

### 3.3. Environmental Security and Global Stability

**Conflict Prevention.** Geoscience contributes to promoting global stability by providing crucial data on climate change and environmental degradation, which can lead to food and water scarcity. By predicting and contributing to mitigating these changes, geoscientists enable proactive international aid and intervention strategies, also mitigating conflict risks.

**Transboundary Resource Management.** Geoscientific input is crucial in geopolitical analysis, where management of transboundary natural resources can influence regional relations and stability, such as water rights disputes requiring detailed geological and hydrological data.

### 3.4. Space and Cyber Security

**Space Weather Monitoring.** Space weather forecasting is critical for protecting satellite communications and navigation systems integral to national security. Geoscientists help predict space weather events that can disrupt satellite communications, navigation systems, and power grids.

**Critical Infrastructure Protection.** Geological expertise supports protection of critical infrastructure through assessment of natural hazards, site selection for sensitive facilities, and environmental remediation of contaminated military sites.

# 4. CRMA Implementation Challenges and Opportunities

## 4.1. Regulatory and Administrative Barriers

CRMA targets appear unrealistic without enforceable compliance and actionable industrial strategy. Permitting timeframes face practical obstacles in Member States with regional autonomies, understaffed administrations, and skills shortages.

The ambitious 27-month permitting timeline for extraction projects and 15-month timeline for processing facilities require significant enhancement of geological expertise within permitting authorities. Current administrative capacity constraints threaten implementation effectiveness.

## 4.2. Skills and Expertise Gaps

There is urgent need to close critical skills gaps in geology, mining, and processing through strengthening education and training, modernising curricula, reinforcing specialised training centres, and expanding international exchange programmes.

The demographic gap in geological expertise, combined with decades of limited research and exploration, has left the EU with insufficient information and expertise on its mineral resources. This knowledge deficit directly impacts defence planning and strategic resource assessment.

## 4.3. Investment and Market Development

The EU needs to open at least 10 new mines, 15 new processing facilities, and 15 recycling facilities for key strategic raw materials by 2030, whilst training 10,000 new workers including geologists, metallurgists, and engineers.

Without dedicated financial instruments and coordinated public-private partnerships, these targets remain aspirational. Defence procurement requirements could provide demand anchors for domestic production but require coordinated strategic planning.

## 4.4. Public Acceptance and Social Licence

Social licence to operate emerges as perhaps the most critical factor in the EU, affecting operations, policy choices, and financing prospects. Community Development Agreements should be founded on equitable partnership principles with negotiated tripartite agreements.

Trust-building requires transparent communication about the defence and security implications of domestic critical raw materials production, contextualised to regional realities and concerns.

# 5. Recommendations For Enhanced Integration

## 5.1. Institutional Framework

**Consider Establishing an EU Geosciences for Defence Centre.** A dedicated institution could serve to:

- Coordinate geological intelligence across Member States,
- Conduct comprehensive resource assessments for defence-relevant raw materials,
- Support strategic stockpile management and early warning systems,
- Facilitate technology transfer and innovation in critical raw materials.

**Explore Integration of Geosciences into the European Defence Fund.** Geological expertise could be embedded in defence research and capability development programmes, particularly for:

- Advanced materials research and substitution strategies,
- Resilient supply chain development,
- Environmental impact assessment for defence infrastructure.

## 5.2. Capacity Building and Education

**Strengthen Geological Education.** Strengthen education from the tertiary level to Lifelong Learning (LLL) through targeted public funding. Action is needed to expand education and training by modernising curricula in core disciplines, reinforcing engagement with other sciences, supporting specialised training centres, and facilitating international exchange programmes. Specific initiatives could include:

- Consider developing defence-focused geology curricula addressing critical raw materials, environmental security, and strategic resource assessment,
- Explore European-wide certification standards for defence-relevant geological specialisations,
- Support exchange programmes with key partner countries for geological intelligence sharing.

**Professional Development.** Enhanced knowledge transfer among professionals and mentorship programmes could help address demographic gaps in the sector whilst building public understanding of geological contributions to security.

- Establish Professional Standards: Implement rigorous ethical, environmental, and professional standards for geologists across Europe, using recognised diploma levels and certifications like the European Geologist (EurGeol) professional title as a benchmark under key EU directives, like the Critical Raw Materials Act, the Net Zero Industry Act, and the Soil Health Act.
- Foster Professional Mobility: Enhance the international mobility of geologists to fill skill gaps and boost European competitiveness. This requires aligning Directive 2005/36/EC on professional qualifications with a common European standard for geology, supported by agreements with non-EU countries.

- Mapping Expertise: We map geological know-how across Europe, with a view to establishing a trusted pool of experts

### 5.3. International Cooperation

**Enhance Geological Diplomacy.** Expanded cooperation with Canada, Australia, the UK, and other global mineral investment partners could leverage both their domestic production capacity and global footprint. Key areas for cooperation include:

- Consider strengthening the EU's participation in international geological cooperation frameworks,
- Explore joint geological survey programmes with strategic partners,
- Support sharing of best practices for sustainable and secure critical raw materials development.

**Third Country Partnerships.** The EU has signed 14 strategic partnerships on raw materials and participates in the Minerals Security Partnership. These partnerships could yield more tangible results through enhanced, coordinated European investment in geoscience diplomacy and technical actions. Existing engagement of EuroGeoSurveys and the Geological Survey Organisations of Europe could be brought under the common banner of a sustainably funded Geological Service for Europe to support this goal.

### 5.4. Research and Innovation

**Advanced Technologies Development.** Research programmes could focus on:

- Advanced extraction and processing technologies with reduced environmental impact,
- Substitution research for higher supply-risk materials,
- Digital technologies for supply chain monitoring and resource optimisation,
- Circular economy approaches for defence-relevant materials.

**Data and Intelligence Systems.** Comprehensive geological databases and monitoring systems could support strategic decision-making and early warning capabilities for supply chain disruptions.

### 5.5. Policy Integration

**Whole-of-Government Approach.** A comprehensive rethink of raw materials value chains as dynamic systems recognises that sustained demand can support purposeful redesign of strategic sectors and value chains. This approach could encompass:

- Integration of geological expertise into defence procurement processes,
- Alignment of environmental, industrial, and security policies for coherent critical raw materials strategies,
- Development of defence-anchored demand for domestically produced strategic raw materials.

**Regulatory Coherence.** Consistency between CRMA implementation, environmental legislation, and defence requirements could be enhanced while maintaining high environmental and social standards.

## 6. Conclusion

The Critical Raw Materials Act represents a crucial step towards European strategic autonomy, but its success depends fundamentally on robust geoscientific capacity and expertise. The intersection of geological knowledge, defence requirements, and industrial capability will determine Europe's ability to maintain technological superiority and strategic independence in an increasingly contested global environment.

The criticality of trust in redesigning resilient and responsible mineral value chains requires coordinated efforts as Member States balance environmental, social, climate, and geopolitical imperatives whilst addressing national interests and community expectations.

European policymakers are increasingly recognising that geosciences serve not merely as technical inputs to defence planning but as strategic enablers of European security and prosperity. Investment in geological expertise, institutional capacity, and international cooperation will be key to determining whether the EU achieves its critical raw materials objectives and maintains its position as a global leader in sustainable and secure resource development.

The time for action is now. The CRMA provides the framework, but implementation requires immediate and sustained commitment to building the geological expertise and institutional capacity that underpins European defence and security in the 21st century.

### About this Position Paper

*This position paper builds upon extensive consultation with geological professionals, defence analysts, and policy experts across the European Union. The recommendations reflect current best practices and emerging challenges in critical raw materials security and defence policy integration.*

### Contact Information

*For further information on this position paper, please contact:*

***European Federation of Geologists:*** *eurogeologists.eu* – *info.efg@eurogeologists.eu*

***International Raw Materials Observatory:*** *intraw.eu* – *info@intraw.eu*

***EuroGeoSurveys:*** *eurogeosurveys.org* - *info@eurogeosurveys.org*