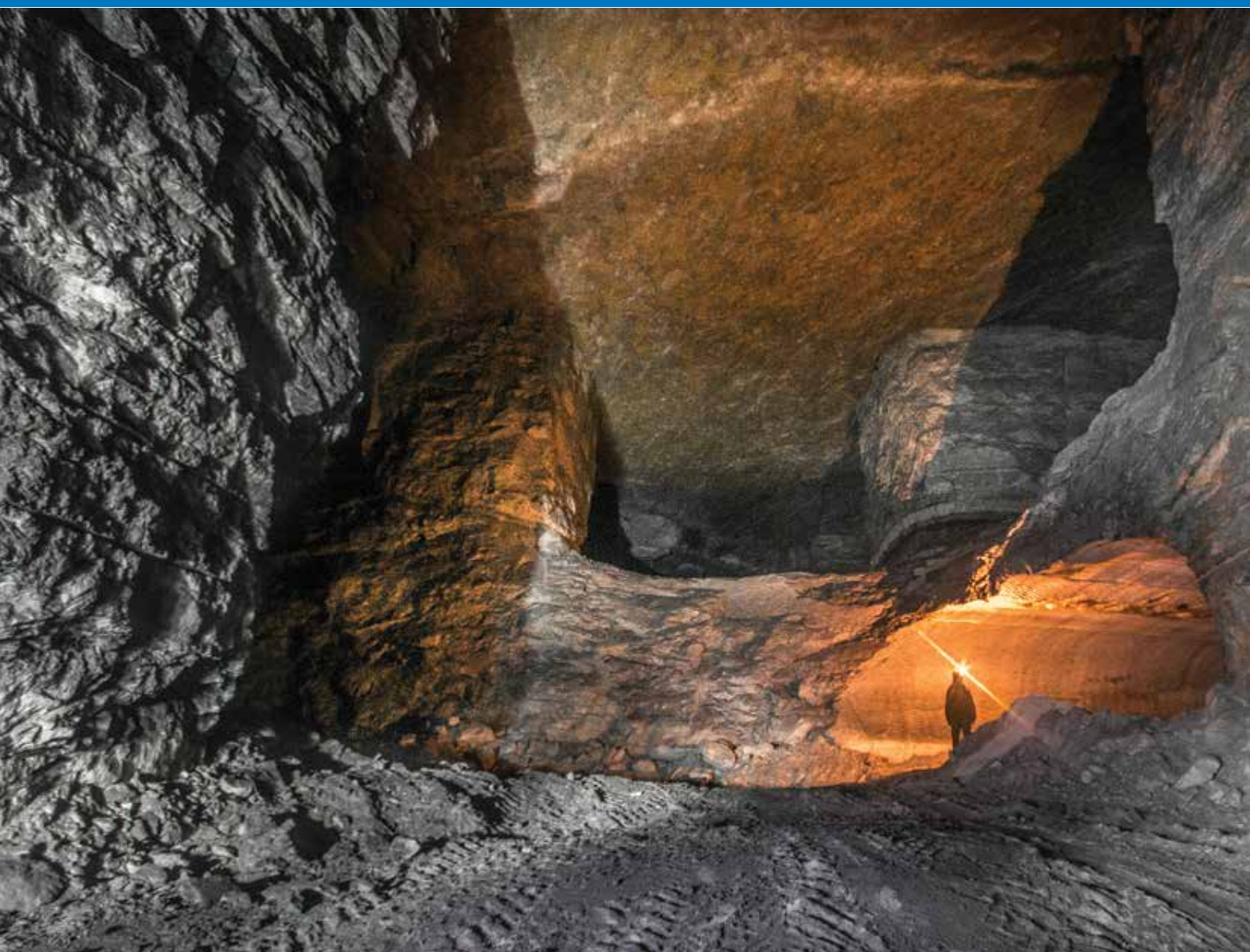
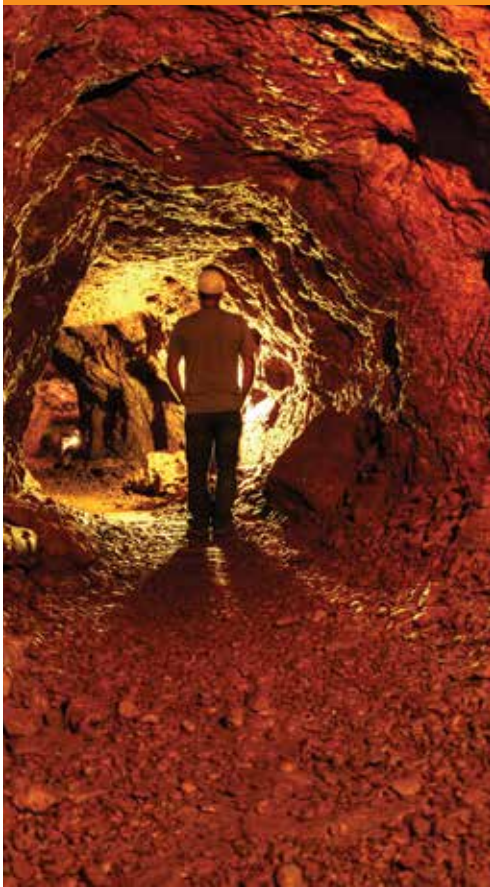


SOLUTIONS FOR THE MINING INDUSTRY





**MAPEI'S UNDERGROUND
TECHNOLOGY TEAM (UTT)
OFFERS A FULL RANGE OF
UNDERGROUND CONSTRUCTION
AND MINING SOLUTIONS:**

- Shotcrete solutions and accelerators
- Admixtures for concrete
- Micro-fine cements
- Chemical and cementitious grouting solutions
- Organic mineral grouts
- Backfill technology
- Waterproofing systems
- Dust dispersion control



MAPEI has a track record of 80+ years for solving problems on a global basis for the construction industry. And for nearly two decades, MAPEI's Underground Technology Team (UTT) has developed solutions for the many complex ground-control challenges and conditions facing the underground construction, tunneling and mining industries.

MAPEI mining solutions have been developed over time to meet the needs of this huge global market. These solutions improve productivity, reduce overall costs, and enhance safety for the mine operators as well as for the mining contractors who specialize in serving their needs.





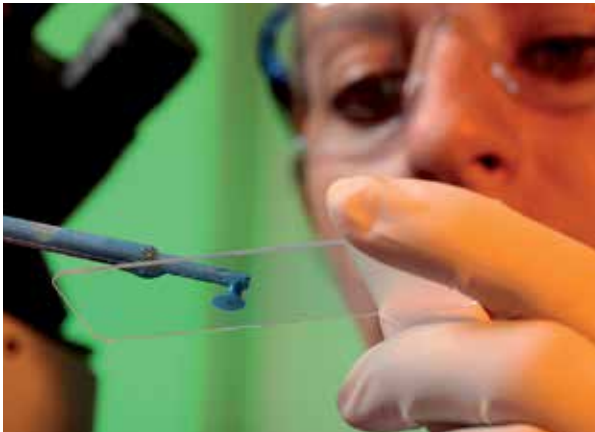
Top-tier products and technologies have been developed by the UTT group to solve common challenges in mining. The UTT group designs solutions that completely satisfy all the technical requirements of our clients who serve the mining industry.

Research and product innovation have become a normal part of the everyday culture of MAPEI and the UTT group. A considerable portion of MAPEI's annual revenue is reinvested in important R&D projects, allowing us to maintain our leadership position around the globe.

MAPEI people make the difference. We focus on the needs of the mining industry with the combined experience of the UTT group and its dedication to solving common and uncommon challenges underground. We support our mining customers where they work underground, in the mines, laboring side by side until the project is completed or the application meets our clients' satisfaction.

The UTT mining services include:

- Technical consulting, support and assistance at the mine site.
- Laboratory testing and support to meet specific application challenges.
- Formulations – the development and optimization of various system solutions.
- Product classification, certification and approvals for the mining industry.
- Client training – personalized, practical site-based training as needed.



MAPEI MINING APPLICATIONS AND SOLUTIONS

SHOTCRETE AND CONCRETE FOR GROUND SUPPORT

MAPEI offers a complete range of proven technology for the needs of the mining customer:

- High-performance, flash-setting, alkali-free accelerators
- Admixtures for shotcrete (mixed base) and concrete
- Admixtures for roller-compacted concrete (RCC)
- Stabilizers
- Air-entraining agents
- Viscosity-modifying agents
- Accelerators/anti-freeze agents
- Curing agents
- Admixtures for lightweight concrete
- Pumping aids

INJECTION SYSTEMS, CONSOLIDATION AND ANCHORING

A full range of ready-to-use cementitious grouts, chemical grouts and chemical resins is available for injection into rock, soil or concrete structures. Designed to improve ground control, control water ingress, stabilize soils and improve anchoring, these products include:

- Single and dual component polyurethane resins for ground consolidation, water-stopping, and soil stabilization.
- Dual component polyurea silicate resins for ground stabilization and polyurea silicate void-filling foams.
- Environmentally friendly mineral grouts for soil stabilization and final injection to create ultra-dry results in water mitigation challenges.
- Micro-fine cements.
- A full range of admixture solutions to improve and optimize Ordinary Portland Cement (OPC) grouts.
- Chemical and cementitious solutions for anchoring applications.
- Acrylic (acrylate) grout solutions for mitigating and stopping nuisance water conditions, soil stabilization and permanent water protection around underground infrastructure.

RENOVATION, MAINTENANCE AND WATERPROOFING

MAPEI offers products for renovation, maintenance and waterproofing activities:

- Dry-mix, prepackaged shotcrete for dry or damp spray techniques
- Fireproof mortars
- High-performance repair mortars, grouts and coatings
- Thixotropic grouts and repair solutions
- Waterproofing systems
- Dust dispersion control



MAPEI's UNDERGROUND TECHNOLOGY TEAM

UTT Technical Assistance provides:

- Sound technical skills aligned with deep knowledge of products, mining methods and methodology, production phases and maintenance processes.
- Technical and consulting assistance in order to focus on the correct products and technical solutions.
- Round-the-clock global intervention, 24 hours per day, 365 days per year.
- Customer-focused solutions tailored to help reduce costs, improve mining production and enhance miner safety.

Globally, the UTT group offers a comprehensive menu of underground solutions for the following areas of underground construction:

- Shotcrete technology
- Mechanized tunneling products (complete tunnel-boring machine solutions)
- Ground consolidation products
- Injection systems
- Waterproofing systems (synthetic membrane and chemical technologies)
- Pavement products
- Tunnel maintenance, rehabilitation and coating products





COMMON MINING CHALLENGES AND UTT SOLUTIONS

UNEXPECTED WATER INRUSH

Unexpected water inrush in tunnels and underground mines creates major safety hazards, production delays and cost increases during excavation. The UTT polyurethane (PU) resin injection systems are an effective and economical solution to quickly consolidate and stabilize the ground, and to help reduce or stop water in these challenging situations.

The UTT group offers a range of adjustable solutions for water ingress underground:

- **Foamjet F** is an ultra rapid-setting, two-component polyurethane resin with fluid consistency, to be injected for consolidating and waterproofing of structures subject to relatively weak water ingress.
- **Foamjet T** is a high-viscosity, ultra rapid-setting, two-component polyurethane resin, to be injected for consolidating and waterproofing of structures subject to strong water ingress.

CAVITY AND VOID FILLING

Cavity and void filling is a common challenge in mining and underground construction. The UTT group offers solutions used to quickly fill unplanned or nuisance cavities to prevent further growth of the cavity. This is an effective solution to longwall roof-fall cavities during excavation and helps get the longwall back in production quickly and safely. MAPEI's polyurea silicate technology solves the problem quickly, safely and economically for cavities of the small to medium size (less than 1,000 cubic meters).

The UTT group offers excellent solutions for quickly filling voids in coal and hard rock mining applications:

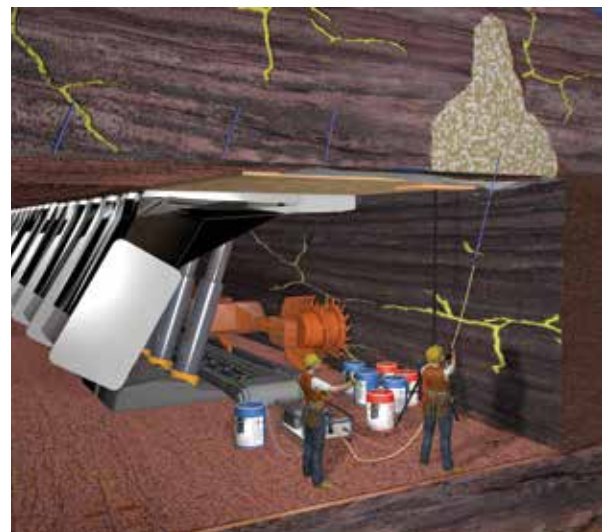
- **Silicajet EXP** is a two-component, organo-mineral (polyurea silicate) resin that is a fast-reacting and high-foaming solution for void filling. It has an expansion factor of up to 40, has a low exothermic reaction temperature (210°F or 99°C) and is self-extinguishing if exposed to flame.
- **Silicajet EXP/4** is a two-component, organo-mineral (polyurea silicate) resin that has fast-reacting and moderate-expansion properties (an expansion factor of 4 with higher foam density for added strength). Its exothermic reaction temperature and fire resistance properties are similar to Silicajet EXP.

GROUND CONSOLIDATION AND SOIL STABILIZATION

The UTT group offers a comprehensive range of chemical, mineral and cementitious grout options to help the mining industry solve common problems in ground consolidation, soil stabilization and pre-injection grouting in advance of mining development. Chemical injection resins include polyurethane (PU) and polyurea silicate (PUS) variations for quick and permanent post-injection applications. Mineral grouts (nano or colloidal silica) are excellent for improving soil stabilization in wet and dry conditions. Cementitious grouts include micro-cements that can be combined with OPC grouts or used in conjunction with OPC grouts to improve consolidation performance and water tightness.

The UTT solutions for mining ground consolidation include:

- **Silicajet ST HP** is a two-component fluid resin with high mechanical characteristics, used for injections into all types of soil, rock and/or concrete.
- **Mapejet System NS 15** and **Mapejet System LP** are ultra low-viscosity, environmentally friendly, two-component, cement-free liquid binders for low and very low permeable ground consolidation.
- **Microcem 10000 IN** is a micro-fine hydraulic binde with pozzolanic action for ground consolidation and ground waterproofing throughout injections of cementitious mixes.



ADMIXTURE AND SHOTCRETE ACCELERATOR

In all the underground mine structures need to use shotcrete to ensure the stability of the structure and the safety of the workers.

The UTT solution are the below:

- **Dynamon Range** is a modified acrylic super-plasticiser for concrete, characterised by its low water/cement ratio, very high mechanical strength and long workability times.
- **Mapetard Range** is a set-retardant for concrete and mortar.
- **Maquick AF 70** is a liquid Alkali free accelerator for shotcrete high range.
- **Maquick AF 350** is a liquid Alkali free accelerator for shotcrete lowrange.
- **Maquick AF 300 DRY** is a powder Alkali free accelerator for shotcrete.
- **Mapagout Gunite 300 AF** is a pre-packed one-component cementitious mortar with accelerated setting for dry mix shotcrete.
- **Mapefiber IT 39 NV** is a structural polypropylene fibres for high ductility concrete and shotcrete.
- **Mapefiber BG 55** is a structural polyolefin fibres for high-ductility concrete and shotcrete.
- **Mapoplast SF** is a mineral addition based on densified silica-fume with pozzolanic action.



ANCHORING

The UTT group also offers specialty admixtures, grouts and anchoring mortars that solve a variety of common problems in mining operations. These products include:

- **Cablejet** is a plasticizing and high-performance, anti-shrinkage agent for slurries for injection.
- **Mapefix EP 385** is a pure epoxy, resin-based chemical anchor for structural loads, certified for threaded bar, construction bars, core-drilled holes and C1 seismic loads.
- **Stabilcem T** is a one-component, pre-blended thixotropic mortar with controlled shrinkage for anchoring, by injection, of tie rods and bolts in all types of grounds.
- **Mapei Rock-In** is a one-component, pre-blended cementitious mortar, characterised by a very quick development of mechanical strengths, for anchoring, by injection, tie rods and bolts in all types of substrates.
- **Silicajet ANK**: Two-component organo-mineral resin for anchoring structural bars.



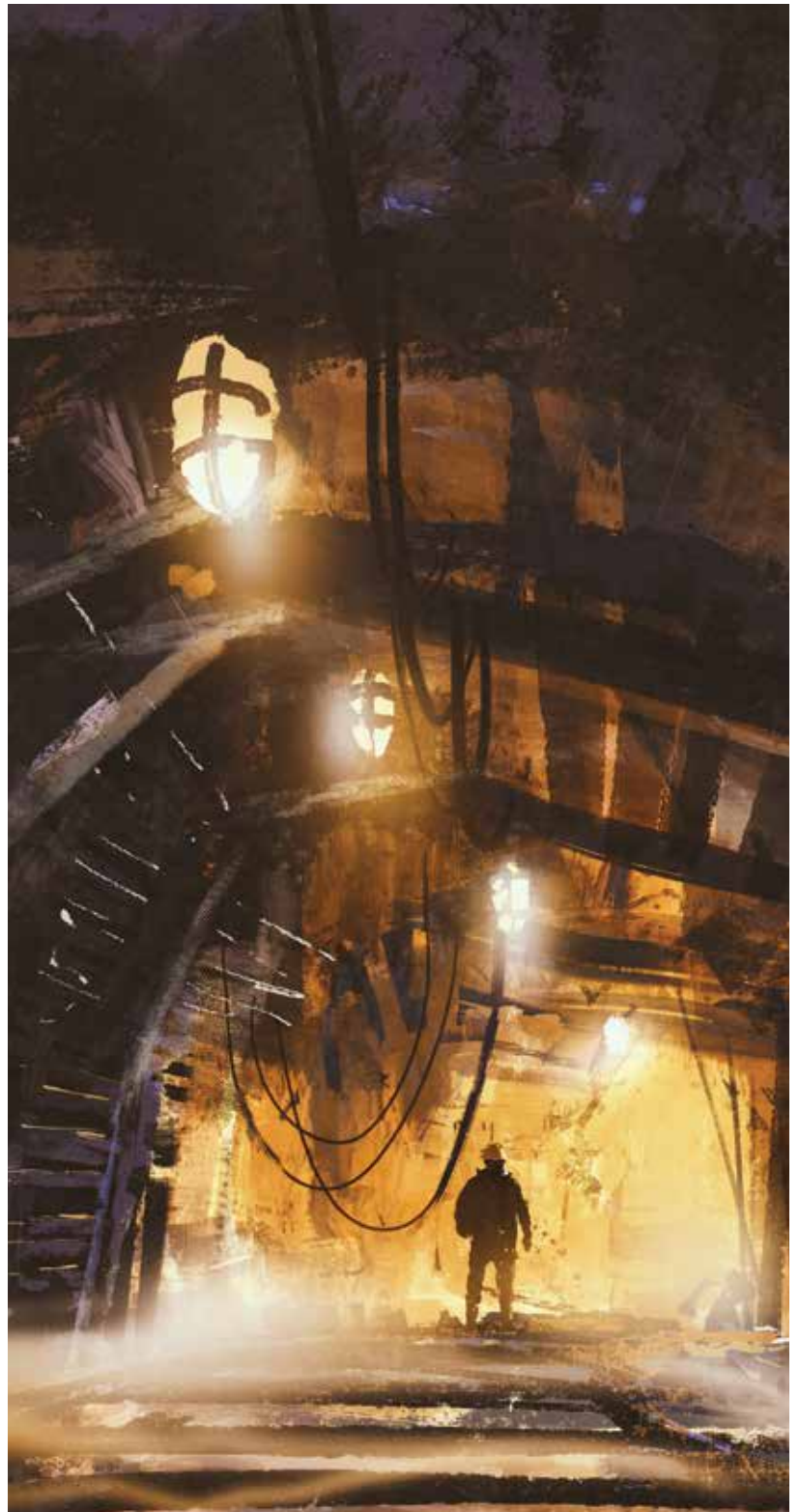


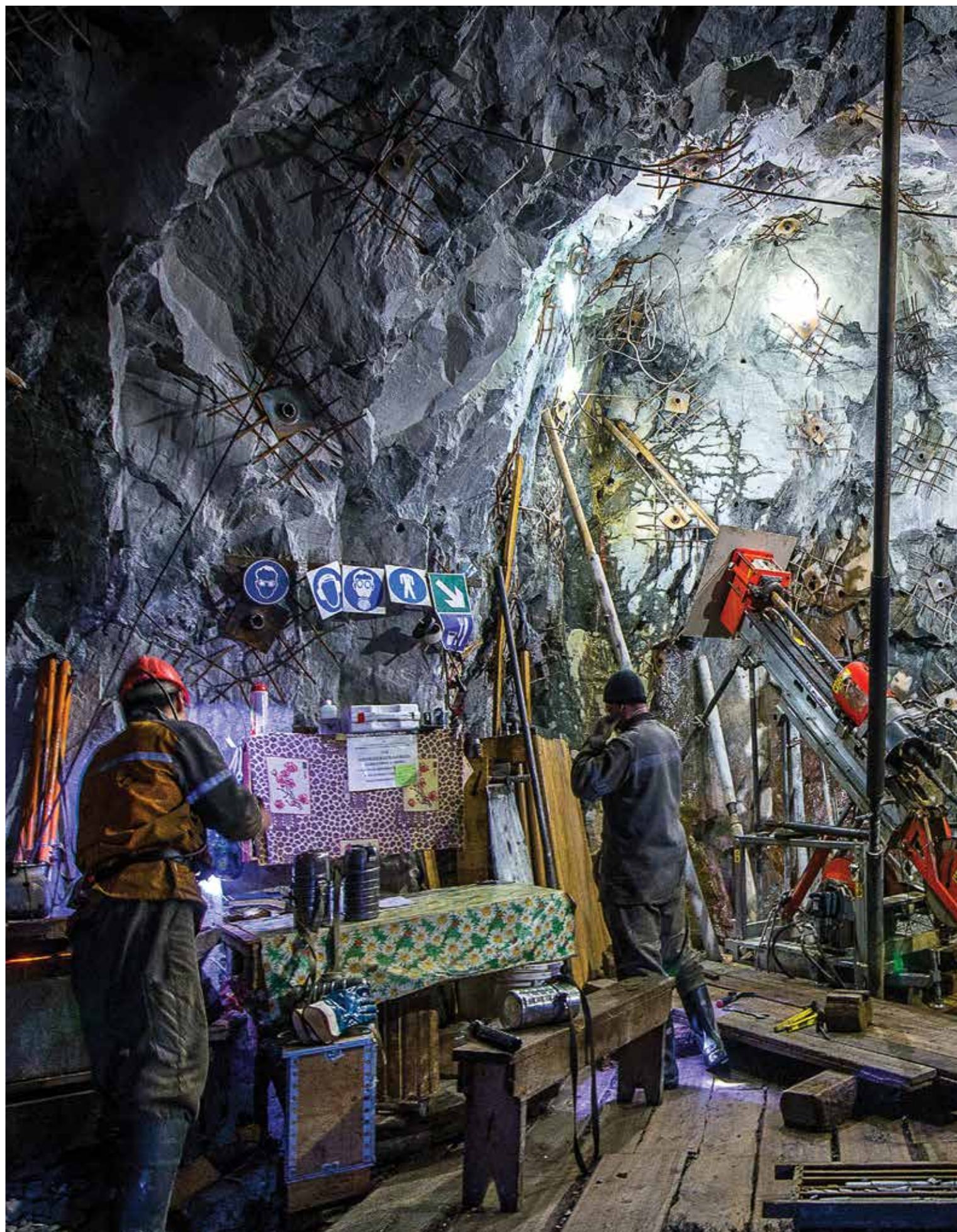
The UTT group is looking forward to serving the ground control needs of your mining operation with a proven, effective and economical set of solutions. The UTT group offers alternatives to the mining industry, and we will create value through the use of chemistry to support your business. The complex challenges facing the mining industry are numerous, and now a proven leader in the manufacture and distribution of underground construction chemicals is just a phone call away.

Consult with our technical team. Visit our website and reach out to the UTT group to help move things forward in your mining operation.

MAPEI'S UNDERGROUND TECHNOLOGY TEAM

WE SUPPORT YOUR MINING OPERATION EVERYWHERE YOU WORK, ABOVE GROUND, UNDERGROUND AND AROUND THE GLOBE.







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