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Battling the Fundamental Forces of the Universe

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Mines, especially deep underground mines, are engaged in producing the metals that feed the global economy. With a continuously increasing global population and expanding material aspirations of this population, the long-term demand for metals is strong. But the resources that were easy to access have been extracted, and remaining ore grades are declining. Ore is either deeper and more expensive to extract, or is found in locations that are more remote from the market that will consume it, and so require more capital infrastructure. The logical extension of this factor - mining asteroids - reveals its absurdity.

Mining at greater depth means managing more geothermal heat as well as more hoisting capacity. The primary purpose of mine ventilation is to remove heat, not to provide breathable air. Conventional hoisting from below 2.5km is not feasible because modern equipment cannot hoist the steel cable, far less a load of ore. Hoisting systems are typically at capacity so that if a logistical failure prevents a tonne of ore from being hoisted on schedule, it can never be hoisted; hoisting it tomorrow simply displaces a tonne of ore from tomorrow's schedule. For hundreds of years mining has been thought of as a mundane and uninspiring activity but the creativity of miners drove the development of steam engines, ventilation systems, elevator systems and breathing apparatus. Mining confronts the challenges of time, gravity and heat every single day - and for all our sakes we have to be successful. Improving the better application of physics to the mining problems of tomorrow is essential for our survival.

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