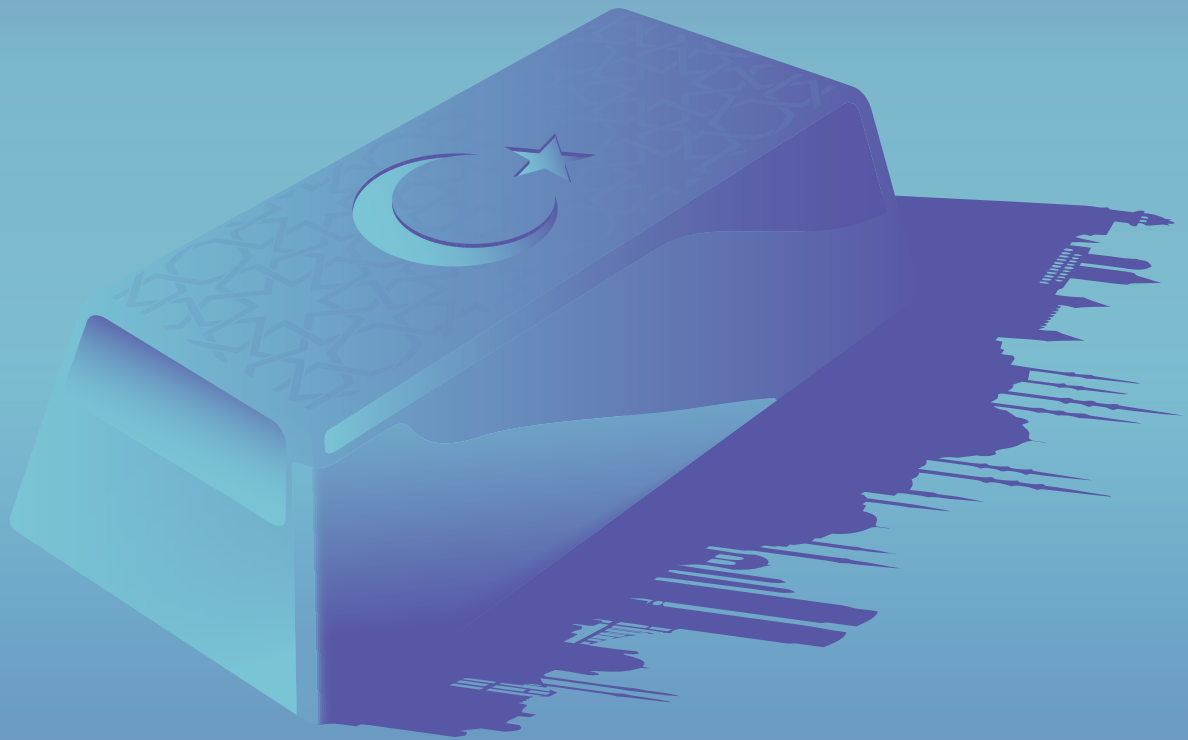


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INDUSTRY EXPLORATIONS



TURKEY MINING 2018



*Economy - Safety - Gold - Coal
Base Metals - Industrial Minerals - Drilling - Technology - Services*



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Dear Reader,

■ ■

The Turkish mining industry has come a long way since the turn of the 21st century. In year 2000, Turkey produced very little gold but now the country is the largest gold producer in Europe. Sitting on a key part of the Tethyan Metallogenic Belt, Turkey is blessed with a diverse array of minerals, including lignite and boron fields, chrome, copper, nickel, magnesium, natural stones, industrial raw materials, rare earths and gold. Turkey's mineral exports make up US\$5 billion, half of which belongs to Turkey's mighty natural stones industry.

Four years on from Global Business Reports' last report on Turkey's mining industry, and a lot has changed. Production of some key minerals and exploration has slowed due to a number of factors such as the global mining downturn and problems obtaining permits. At the same time, the Çöpler mine, the second largest gold reserve in Turkey, has undergone a major expansion through the Çöpler Sulfide Expansion Project. Turkey has also continued to expand its potential through the General Directorate of Mineral Research and Exploration (MTA)'s impressive drilling program, which achieved 1 million meters in 2017 and aimed to achieve 2 million meters in 2018.

Recently, the government transferred 203 million mt of coal reserves to private players and continued large investments in the sector as Turkey aims to cut energy imports. It has been another volatile year for chrome prices but Turkey remains a vital player in the global ferrochrome supply chain, and Turkey's potential in other metals like zinc and copper continues to attract investor interest, including from abroad. Meanwhile, this year Turkey's National Resources and Reserves Reporting Committee (UMREK) was accepted by the Committee for Mineral Reserves International Reporting Standards (CRIRSCO), which is a stamp of approval of the international standards present in Turkey's mining industry. And of course, Turkey entered a new era with the transition to the presidential system after the June 2018 elections and received a new Minister of Energy and Natural Resources.

It is more than four years on from the Soma mine disaster, something which the industry will never forget. Safety will be a key theme at the Turkish Miners Associations conference this year. There is recognition across all companies that safety is fundamental. In the pages that follow, we will look at how to change the safety culture so that nothing like Soma can be allowed to happen again.

In this report you will find interviews with some of the leading players in Turkey's mining industry, offering their insights on recent company developments, the operating environment and future prospects for the industry. Despite challenges, not least economic, there are reasons to look to the future with optimism that Turkey's varied mineral resources can reach their full potential. Turkey's mining industry is still young and its best days may well be ahead of it still.

We hope that you will find value from the insights and analysis that are contained in this book.



Alice Pascoletti
General Manager

Global Business Reports



Ali Emiroğlu
President

Turkish Miners Association

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TURKEY MINING 2018
Industry Explorations
Global Business Reports

This research has been conducted by
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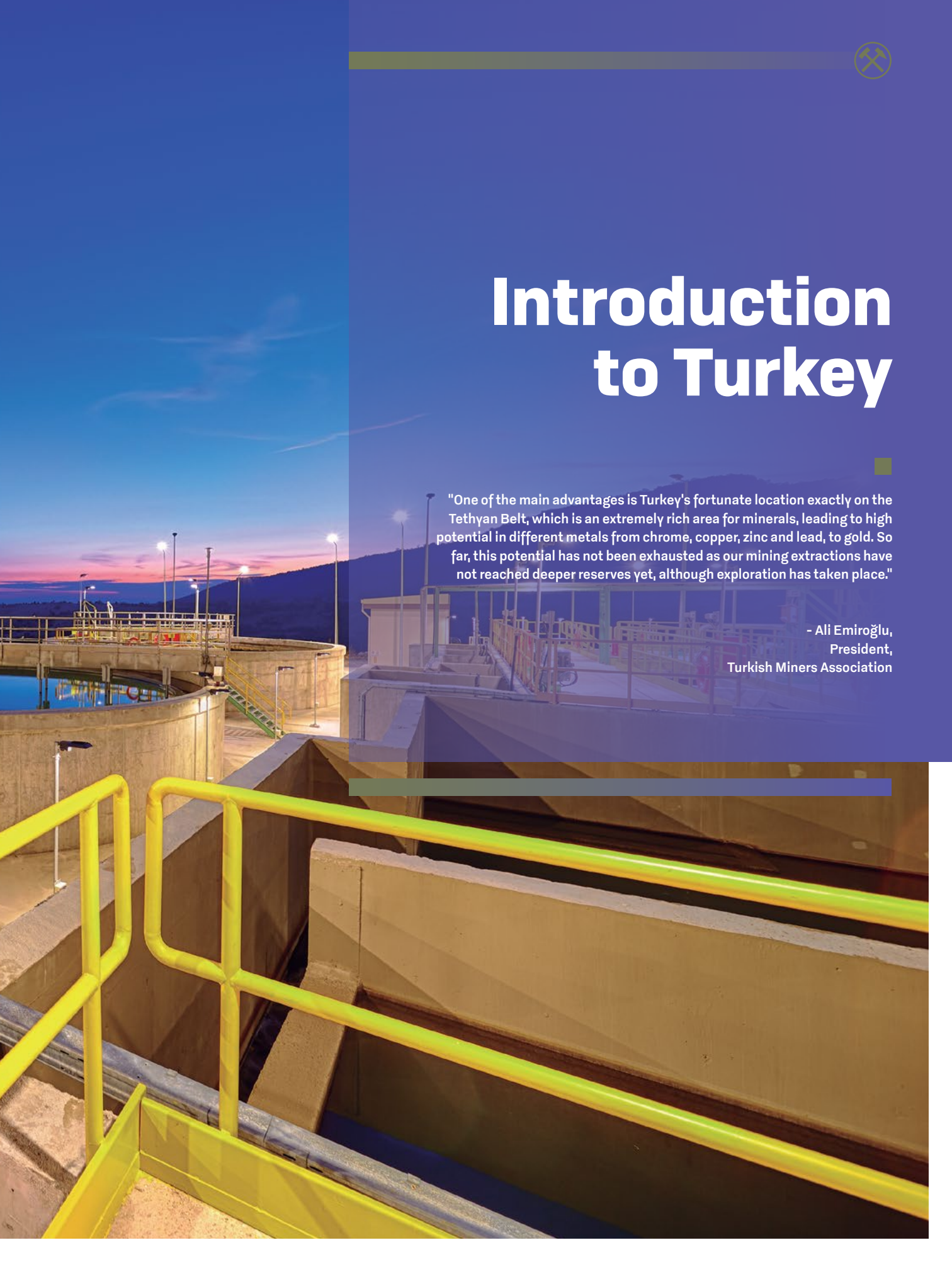




Introduction to Turkey

"One of the main advantages is Turkey's fortunate location exactly on the Tethyan Belt, which is an extremely rich area for minerals, leading to high potential in different metals from chrome, copper, zinc and lead, to gold. So far, this potential has not been exhausted as our mining extractions have not reached deeper reserves yet, although exploration has taken place."

- Ali Emirođlu,
President,
Turkish Miners Association



A New Era for Turkey

The country transforms into a presidential regime

Turkey's economy has grown at an average annual rate of 6.8% since the global financial crisis hit in 2008-09, rivalling emerging market growth stars such as China and India. In fact, over the last twenty years, Turkey has become an upper-middle income country, as defined by the World Bank, underpinned by macroeconomic and fiscal stability. Also, Turkey urbanized dramatically, opened up to foreign trade and finance and harmonized its laws and regulations with EU standards.

For a country of seemingly perpetual uncertainty, since the AK Party came to power in 2002, there was relative stability until at least 2013, when the Gezi Park

protests broke out and arguably until the failed coup attempt of 2016. That day on the 15th July 2016 fundamentally altered the course of the Turkish Republic in ways which are still reverberating. Less than a year later, in April 2017 President Erdoğan won a referendum to transition the country from a parliamentary to a presidential system.

Fast-forward two years later and President Erdoğan has been re-elected as Turkey's first president under the new system which promises to streamline decision making and transfer all the responsibilities of the prime ministry, which will be abolished, to the presidency. Additionally, members of

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INTERNATIONAL MINERS' DAY



TURKEY AT A GLANCE

Source: IMF, data for 2017

Capital city: Ankara
GDP: US\$849.5 billion
GDP growth: 7%
Head of State: President Recep Tayyip Erdoğan
Total investment (% of GDP): 30.9%
Gross national savings (% of GDP): 25.8%
Current account balance (% of GDP): -5.5%

parliament will not be able to serve as cabinet members, which will instead be appointed by the president, as will high level executives of public institutions and universities. Importantly, with the new constitution, the impartiality of the president will be removed, meaning the president can be affiliated with a political party. The president is also able to enact certain laws by decree, although parliament can bring such decrees before the constitutional court for review, and the annual-state budget is now drafted by the president. Overall, therefore, the presidency assumes much more power than before.

Economic fears

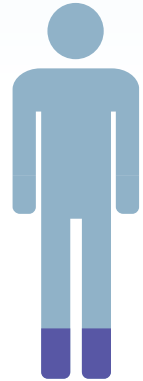
Turkey continued its impressive growth track record in 2017, recovering from the adverse effects of the coup in 2016, with a stellar 7.4% growth rate beating expectations. However, since then, Turkey has been experiencing economic turmoil, precipitated by a sharp fall in its currency, which lost 45% of its value between January and October 2018, reaching record lows in August. It is still one of the worst performing currencies this year, along with the Argentine peso.

The lira's fall has made imports much more expensive and emboldened the Turkish government's desire to develop more domestic resources, especially in coal. It has also increased costs for mining companies, though, and made it more difficult to obtain bank credits. The focus for most companies seems to be on retaining, rather than expanding business. It does not help either that consumer inflation was at almost 25% in September 2018. Turkey's economic confidence index plummeted by over 15% in the same month, the biggest drop since November 2008. The IMF now expects Turkey's economy to grow by just 0.4% in 2019, instead of its previous fore-

DEMOGRAPHIC DATA

Source: IMF, data for 2017

POPULATION
80.8 MILLION



UNEMPLOYMENT RATE
11%

GDP per capita

US\$10,512

GDP per capita (PPP)

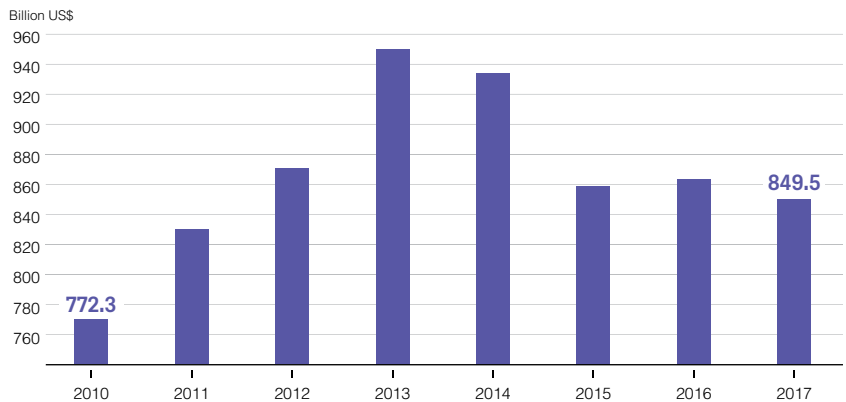
US\$26,893

Inflation rate

11.1%

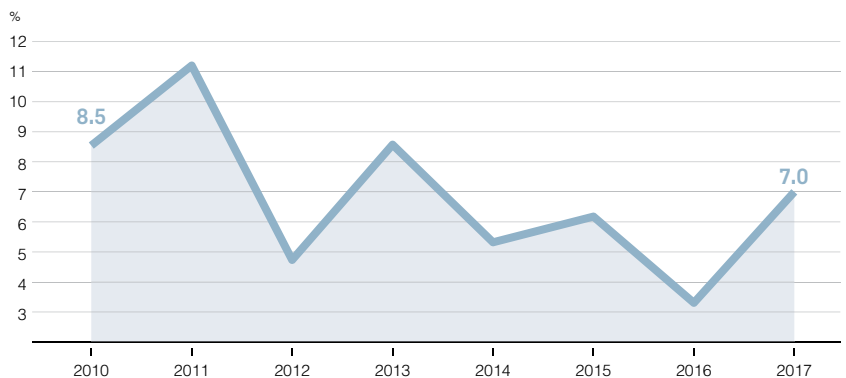
GDP EVOLUTION IN US DOLLAR VALUE

Source: IMF



GDP GROWTH

Source: IMF





Fatih Kaya

Senior Consultant
INVIST FC

cast of 4%, although growth in 2018 is still relatively healthy at 3.5%.

A significant part of Turkey's impressive growth over the last decade and a half has been driven by the construction sector which, although showing signs of faltering in 2018, is still a key driver for mineral resources and the economy overall. "Turkish companies are increasingly getting contracts for building airports, roads, and other infrastructure projects abroad. Domestically, because of pressure on the lira, construction companies may experience lower sales. Nevertheless, Turkey has a growing population so there will always be a need for construction," affirmed Selim Levi, trader at Ekin Maden, one of Turkey's leading metal and ore concentrate traders. "Also, the government is lowering taxes and stimulating credit for housebuilding. There are many people employed in construction so the government wants to keep it going."

With the new presidential system Turkey enters a new era. Turkey's policies have been extremely foreign investment and business friendly over the last 15 years. Partly this reflects Turkey's need for foreign capital given its persistent current account deficit, which was US\$47.1 billion in 2017, but it also reflects Turkey's openness to the world. Unfortunately, foreign direct investment has fallen in recent years, most recently dropping by 22% from January to April 2018. Companies are hoping that the presidential system lives up to its promises to remove barriers to business, counteracts the incoming economic storms and achieves more foreign investment. "We also need institutional reform of the economy. So, it will take time for higher levels of foreign investment again, perhaps 1.5 years," remarked Fatih Kaya, senior consultant at Invist FC, which advises companies looking to invest in Turkey.

Overall, it looks like there will be a continued rocky period in Turkey's economy before things improve. ■

What was the motivation behind the establishment of Invist FC?

Invist FC is a strategic consulting company established by a group of partners coming from different social backgrounds including academia, politics, civil society and the government, to bridge the gap between the public and private sectors in Turkey. Additionally, it was founded to transmit key messages of the private sector and make an impact in the determination of public policies.

We work on internationally accepted toolkits such as policy modelling, economic modelling, general equilibrium models and other economic impact assessments to take our messages to the government. We saw that there was an analytical deficiency in the communication between the private sector and the government. So, Invist FC is a local company using international methods. We do not believe in a clear separation between public and private interests and through our work we contribute to the sustainable economic health of our nation and a better business environment to attract capital, which has become scarcer globally.

How does Invist FC work with the mining sector more specifically?

We work to increase the business sustainability of mining companies. There are 21 permissions and authorizations issued by the government, which means it will take 2.5 years for a mining company to start operations, if they are lucky. This is too long and neither is the process effective enough in protecting the environment, business interests, labor security and social strata. It also deters many foreign companies from investing in Turkey. We try to put our arguments on the table in this regard when interacting with the government, which can help modify public policy when government officials can see the economic value in them.

How do you see the levels of foreign investment changing in the next one to two years?

Local elections, due to happen in March 2019, are important in Turkey, so the country will be in an election cycle until then. This affects investment decisions due to concerns about sustainability and vulnerability of investments. We also need institutional reform of the economy. So, it will take time for Turkey to receive higher levels of foreign investment again. ■



Ali Emiroğlu

President

TURKISH MINERS ASSOCIATION

The TMA is highly concerned about safety [...] Of course, you cannot change the world from one day to the other, but you need to start somewhere and follow this road for a minimum of five to ten years to implement a certain culture.

Could you introduce the main aims of the Turkish Miners Association?

The Turkish Miners Association was created in 1948 and is Turkey's oldest mining association and the only surviving one. The TMA represents up to 90% of the mining producers and our membership contains 69 legal companies as well as 39 private individuals. So, our focus is on the representation of the 85% to 90% of Turkey's mining producers. Our members include some of the country's biggest mining companies, government-owned companies, associations like the Turkish Coal Association, and foreign investors from countries like Canada.

Our mission is to support the Turkish mining industry, trying to find solutions to our members' problems on a governmental level and securing the Turkish mining industry's workplace safety and legal framework. We work step by step to gain more recognition and broaden our audience, ensuring our voice is heard.

What are the main strengths of Turkey's mineral reserves?

One of the main advantages is Turkey's fortunate location exactly on the Tethyan Belt, which is an extremely rich area for minerals, leading to a high potential for chrome, copper, zinc, lead, and gold. So far, this potential has not been exhausted as our mining extractions have not reached deeper reserves yet, although exploration has taken place.

The government has shown serious interest in supporting this cause by making analyses on a meta-basis to locate minerals. They achieved their target of 1 million meters of drilling last year and this year aim to increase that to 2 million meters, and next year 3 million meters. Foreign and private players are also doing a lot of research. Marble, not only minerals, has high potential, and the reserves are highly remarkable, in terms of the different colors and qualities available.

What initiatives is the association involved in with regards to safety?

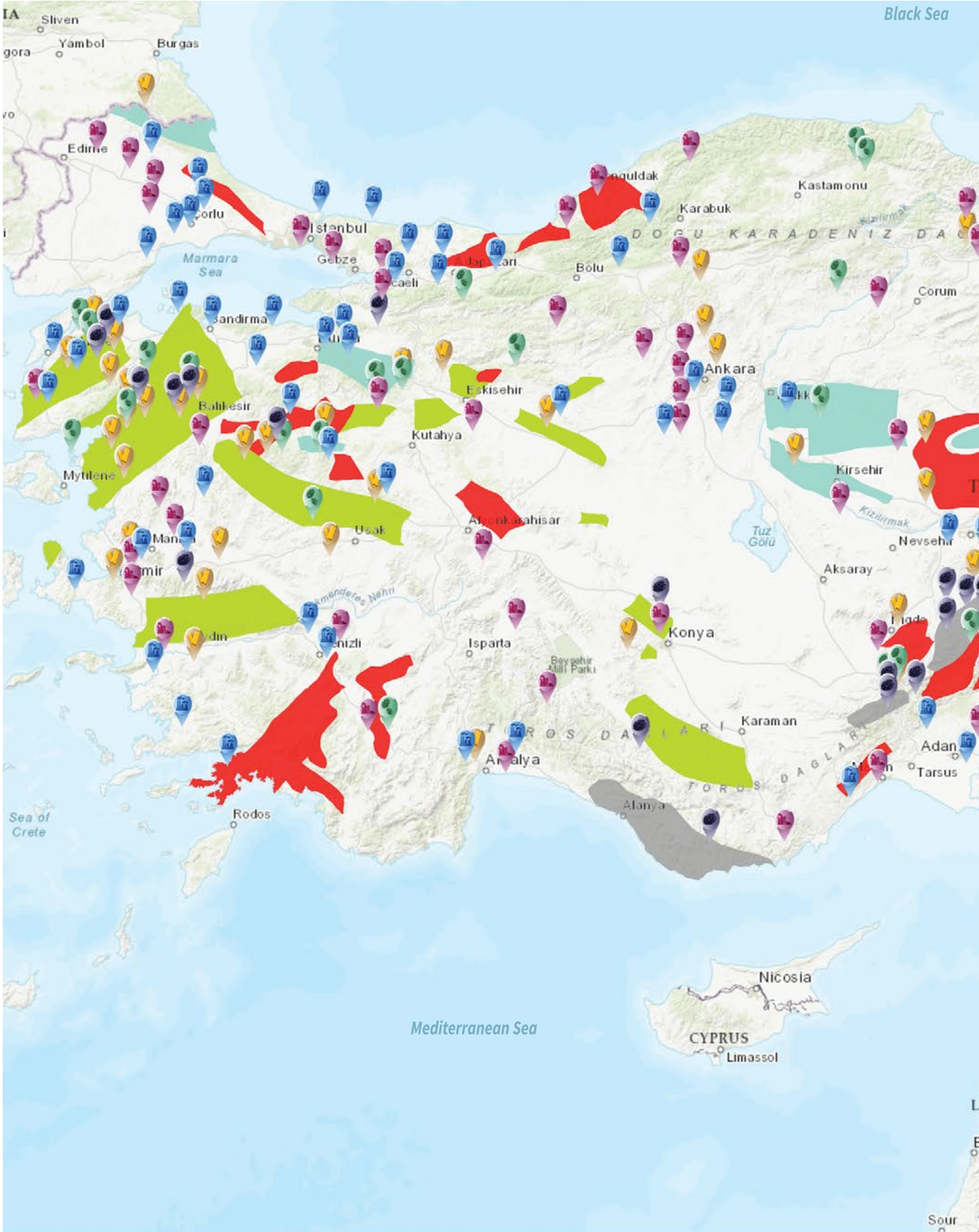
The Soma incident is the biggest blot on the Turkish mining industry's history and a disgrace for all of us, which fills us all with great grief. It has changed Turkey's

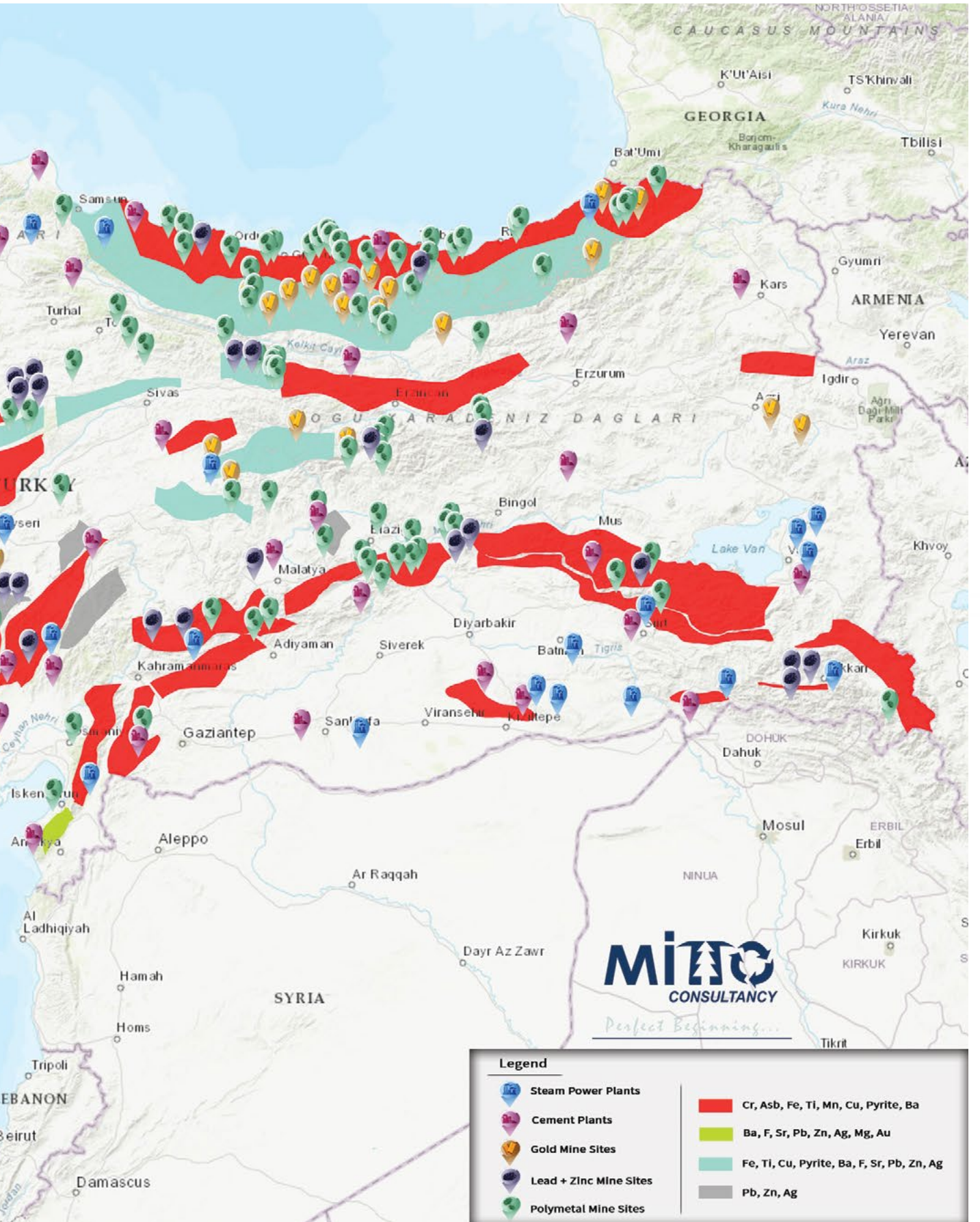
view regarding workplace safety and legal regulations around it, shifting to a more concerned mindset from Turkish mining companies as well as the government. Right after Soma the government launched some very restrictive regulations; some of them were done in a rush, so their development is still ongoing.

The TMA is highly concerned about safety. Right after Soma we organized an international conference regarding safety in the workplace, on the international mining day which falls on the 4th of December. We had guests from the international mining industries of the United States, Canada, Australia and China. Lectures and discussions were held, as well as workshops and we noted very important aspects for companies and the government as well. Of course, you cannot change the world from one day to the other, but you need to start somewhere and follow this road for a minimum of five to ten years to implement a certain culture. Our second conference was held in 2016 and this year our third conference will take place, with speakers from countries with large mining industries. There will be speakers from different actors such as government, universities, companies etc. From Turkey there will be around 10 speakers. Also from Italy we will have guests from the marble industry talking about mining safety. Soma is still a bleeding wound for us. We will keep up our work to make sure this never happens again.

What are your objectives as the new President of the TMA and what is your vision for the mining industry?

The TMA is celebrating its 70th anniversary. After taking the flag from my predecessor Mr. Sökmen and the former management team, of which half has been renewed, our aim is to carry out the TMA mission with grace, rather than implementing any revisions to an already well functioning mechanism. There will not be significant changes to the TMA's policy and our existing principles and ethics concerning workplace safety, as well as environmental sustainability, will remain our core objectives. Also, we want to improve the industry's techniques so Turkey can use its reserves more productively, always having international standards in mind. ■





Legend

	Steam Power Plants		Cr, Asb, Fe, Ti, Mn, Cu, Pyrite, Ba
	Cement Plants		Ba, F, Sr, Pb, Zn, Ag, Mg, Au
	Gold Mine Sites		Fe, Ti, Cu, Pyrite, Ba, F, Sr, Pb, Zn, Ag
	Lead + Zinc Mine Sites		Pb, Zn, Ag
	Polymetal Mine Sites		

Safety in Turkish Mines

Turkish mining in the dock

On the 13th May 2014, a tragedy befell Turkey in Soma, 95 km from İzmir on the Aegean Coast. 301 miners died in the Soma mine disaster, most from carbon monoxide poisoning, after a power distribution unit exploded and caused a fire that spread to coal dumped around a transformer. A report into the safety of the mine, which had been lauded as one of Turkey's safest and more technologically-advanced before the tragedy, found that it was lacking in carbon monoxide detectors, had poorly maintained gas masks and was not properly ventilated. The fire was closer to the exit than were most workers when it occurred but hundreds followed emergency instructions when they saw smoke and went deeper into the mine, hoping that oxygen would be pumped to where they were. It was not, and this is what caused most loss of life. "The disaster happened because of poor ventilation resulting from bad mine design. There was one gallery with everything inside it: coal, conveyor, personnel intake and ventilation, all in a 14-m² tunnel. In our Zonguldak project, for example, these are in separate locations," remarked Mustafa Bayar, general manager, Bayar Industrial Services and Plants Mechanical Manufacturing. Soma was the worst mining accident in Turkey's history and the 19th worst globally, with several mining executives now having been convicted for their role in it. 2014 was heavy on the hearts of the whole

Turkish mining industry, and it is still upsetting for many today. To add insult to tragedy, in October 2014, 18 miners died when water flooded the Ermenek mine in the Karaman province in southern Turkey. These disasters drew bitter memories of another huge loss of life due to mining in Turkey in 1992. Then the ageing Incirharmani mine in the Zonguldak coal mining area by the Black Sea coast was transformed into a firestorm as methane gas built up rapidly and caused an explosion, leaving 263 dead.

A persistent problem needs urgent answers

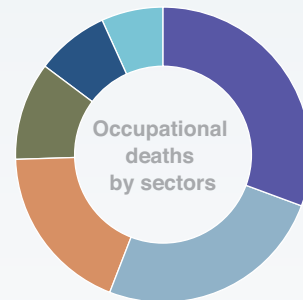
Turkey has long had a poor occupational safety record, including in mining. In 2017, 2006 workers were killed in occupational accidents, 36 more than in 2016, according to the Workers' Health and Work Safety Assembly (ISIGM), with 93 deaths in mining. The mining deaths figure is exactly the same as the average number of mining deaths from 2000 to 2014 when Soma happened, underlining the challenges in reducing mining deaths. South Africa had similar instances of mining deaths in 2017, with 82 in the months from January to November, and 73 deaths in 2016 – the lowest on record. However, South Africa has a much larger mining industry than Turkey's, as well as many

DEATHS AT WORK 2017

Source: Workers' Health and Work Safety Assembly (ISIGM)



	# of deaths	%
Men	1,890	94%
Women	116	6%



	# of deaths	%
Construction	453	23%
Agriculture	385	19%
Transportation	272	14%
Trade	154	8%
Iron and Steel	116	6%
Mining	93	5%

underground mines. Therefore, Turkey's record should be better than South Africa's. Australia, which also has a much larger mining industry than Turkey, recorded only three mining fatalities in 2017.

The reasons for this poor record are not entirely certain but it is clear that there was serious negligence in the Soma mining disaster, especially in the areas of safety equipment and ventilation. Also, according to Mehmet Utkan, the Soma mine's underground safety engineer who was off duty at the time of the accident, non-fireproofed material was used in the electrical system of the mine. Furthermore, the mine had no functional safe rooms and included much manual labor, being only partly mechanized. Only one of the underground galleries had crushing and cutting machines to mine coal, whereas the other three were operated by manual labor.

Regarding the Ermenek mine disaster, an alarm system would have helped to save the lives of the miners, according to a Turkish prosecutor at a court hearing on the tragedy held in 2016. Also, drilling was conducted just three meters from waste water, which flooded the mine, instead of the recommended 25 meters. Furthermore, no documents were found pertaining to worker training, meaning miners did not know what to do when the accident happened.

Most mining accidents happen in coal mines but, with so much of Turkey's mineral resource deep underground, miners across all minerals are solemnly committed not to repeat disasters like Soma. "In order to ensure safe operations for our underground workers, the furnace is constantly ventilated, and gas measurements are made and recorded by responsible mining engineers at every shift," said Cansu Çopuroğlu, sales and marketing director at base metals producer Marmotek Madencilik.

The mechanization of some mining activities could also take workers out of harm's way. Zinc producers Pasinex have semi-mechanized mining in the development and stopping phase of their Pinargozu mine in the Adana province.

Unintended consequences

In the aftermath of the Soma and Ermenek accidents, Turkish lawmakers were compelled to introduce a new occupational

health and safety law. "After the disaster, health and safety regulations increased a lot. For example, employing a health and safety manager became compulsory and European standard regulations for coal mines were introduced," said Bayar.

Aligning with European standards has been a positive step, but has added extra cost to mines which are not involved in underground mining. "We have hired specialists in workplace safety who work as external consultants and continuously inspect our mine and production plant," said Akin Bayazit, sales and marketing manager of Akdeniz Minerals, which does not have underground mines.

Also, the tightening has caused some mine owners to evade responsibility for accidents, the reverse of what was intended by regulation. "After the [Soma] accident everything changed, including the mining law. For example, board members at mining companies are now responsible for accidents. This has meant mine owners are not putting themselves on boards and foreign investors either do not invest or ensure their domestic partner holds the risk. We are trying to change this aspect of the law," explained Prof. Dr. Güven Önal, president,

Turkish Mining Development Foundation. Sadly, such behavior will do little to improve Turkey's mine safety record, and suggests regulations are simply not enough and that they need more careful design. In any case, solutions must come from the industry and companies themselves if the record is to improve.

Rules and training are not enough, a change in culture is needed

An important step to improving mining safety is of course to have proper training and rules in place, as well as good mine design and appropriate use of technology. Many Turkish miners take this extremely seriously, while too many still do not, as the safety statistics show.

Marmotek Madencilik has an advanced approach to occupational safety in its underground mines, as Çopuroğlu explained: "Before all our employees get started, they are provided with the detailed information about the work to be done and undergo occupational orientation (basic education) training. Also, the machines and equipment to be used are introduced, and they

Image courtesy of Alser Madencilik



are informed about underground mining. PPE (personal protective equipment like helmets, boots, gloves, dust masks, etc.) are given to them in accordance with the work to be done. In case of emergency, there is an emergency path established from the entrance of the quarry to the working areas. Our employees are followed with personnel monitoring systems and the possible negative effects are immediately intervened upon.”

Similarly, Pasinex has a surveillance monitoring system for its underground operations. “Pasinex continuously trains and educates its labor force, has put a safety culture in place, and applies both local and international standards. So far, we have had no fatalities and we hope this will continue. Continual safety awareness is very important, and it is a topic of discussion at the beginning and end of every shift,” explained

K. Soner Koldas, country director, Pasinex. Koldas’ use of the ‘culture’ word is intriguing and chimes with some of the latest thinking among safety experts. Corrie Pitzer, CEO of SAFEmap International, witnessed mine deaths in South Africa in the early stages of his career as an HR manager at a mine. Pitzer recounts the transformative impact visiting the bereaved relatives had on his career and that of his mine manager at the time. “We start with a mantra that a company’s culture will trump its system every time,” said Pitzer, although he acknowledges culture is an elusive concept. “The best way to describe it, is what someone does when no one is looking; people act based on their perceptions of what is required and permissible.”

He also believes that too much discipline can harm the culture of an organization and is wrong-headed because “there is a dif-

ference between willful risk taking such as not wearing mandated protective equipment and unintentional mistakes caused by cognitive errors. The former requires discipline, but the problem is that most accidents do not occur in this way throughout willfulness.”

Pitzer acknowledges the importance of systems that can have a huge influence on people’s behaviors but insists they will not have the desired effects without a strong company culture on safety.

It is clear that from Turkey’s tragic mining disasters neither an adequate safety system or an appropriate culture has existed among many Turkish companies. “The main principle of our company is that *Nothing is More Important or Urgent Than Work Safety*,” remarked Çopuroğlu.

May that become the mantra for the future. ■



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Corrie Pitzer

CEO
SAFEMAP INTERNATIONAL

“ We go to organizations and ask employees why their employers want them to be safe and get very interesting answers; most of the time they answer that their companies want good safety records, very seldom do they say that it is because the company cares about their safety. ”

What are the psychological underpinnings behind SAFEMap’s services?

We start with a mantra that a company’s culture will trump its system every time. I have been working on defining culture for 25 years and I still do not completely understand it. I would indeed challenge people who say they do because it is a dynamic influence that lives in the perceptions of people and changes all the time. The best way to describe it, is what someone does when no one is looking.

I worked 2km underground in a mine and got to understand how underground miners perceive their world. In such mines people act based on their perceptions of what they must do, rather than rules. It is important to understand people’s intuitions and we measure this through an anonymous survey using a forced choice technique. It is a huge shock for organizations to see how their employees really act and think, and this methodology leads to very different results to the standard questionnaires used in typical surveys.

What are some of the key safety topics in deep underground coal mines?

From a worker perspective, coal miners are more subjected to the constant presence of risks, dangers and hazards than other deep underground miners simply because the environment is more volatile, such as through rock falls and roof collapses. Also, there are the hazards of methane and dust, which leads to a greater degree of risk tolerance. That sounds odd but the more risk people are exposed to, the more they tolerate risk to cope with the environment. As Turkey increases its underground mines, this will be a big threat.

The biggest risks in coal mining are fall of ground and the collapse of side walls. They require significant rock engineering and coal mining design with adequacy of pillar sizes. Also, continuous miners with shuttle cars introduce a whole new set of risks to the underground operator. For instance in South Africa, coal mining equipment are all fitted by law with proximity alert systems. While that sounds like a great idea – people are warned when they are close to machinery – it introduces a completely different level of risk, as people become even

more risk tolerant (over confident), meaning they are more exposed.

How do you change culture within an organization?

It boils down to leadership’s vision of safety; a vision can be very vital to a culture when everyone knows about it, or completely useless if people do not care about it or they do not even know what it is. We go to organizations and ask employees why their employers want them to be safe and get very interesting answers; most of the time they answer that their companies want good safety records, very seldom do they answer that it is because the company cares about their safety.

What should the role of discipline be in safety?

There is a difference between willful risk, taking such as not wearing mandated protective equipment, and unintentional mistakes caused by cognitive errors. The former requires discipline, but the problem is that most accidents do not occur in this way throughout willfulness. Safety programs are actually constraining business because they contain very prescriptive ways of doing a task. We believe that is essential to take risks in order to improve performance and deliver innovation and results. Risk-taking behavior is thus the goose that lays the golden egg. This is a major philosophical incompatibility to most safety philosophies which stress compliance and avoidance of risk and thus kill the goose. If the Wright brothers did not take risks we would not be flying today.

How will automation impact safety?

Automation and artificial intelligence can add a lot of value through the reduction of people exposed to risk, but it will not give us the moral decision making power that is the basis of safety. We are creating complexities in technology so that when something goes wrong it could be catastrophic. In the long term we may see a dramatic increase in such events due to the concept of tight coupling: there are a lot of steps in the production process, and if one goes wrong there is not enough time to recover mistakes. ■





Turkey's Mineral Production

"Turkey is still relatively new to mining but there are a lot of reserves, and after the privatization drive the industry grew rapidly. However, we still do not have a high enough level of exploration and there are social and environmental problems, which means it is difficult to get permits. We know there are a lot of gold reserves, with some still waiting for permits."

- Erdem Tüzünalp,
Regional General Manager, Turkey & MENA,
Epiroc



Turkey's Mining Industry Looks to the Future with Hope

Despite the challenges, the sector is developing

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Sitting astride a significant portion of the Tethyan Metallogenic Belt, one of the world's major metal producing areas, Turkey is rich in a very wide array of minerals. Although Turkey occupies one of the most prospective parts of the belt, which stretches all the way to Southeast Asia, its mining industry is young as its geology has only been seriously explored in the last two decades. According to MinEx Consulting, exploration expenditures in Asia Minor (Turkey and Greece) totaled US\$0.96 billion from 2006 to 2016, lower than other regions in the Tethyan Belt like the Himalayas or Southeast Asia, but yielded far more discoveries: 22 (mostly in Turkey) compared to six and seven in the former mentioned regions, respectively.

Following the privatization of Turkey's mining industry, the progress made in the last 20 years is nothing short of spectacular, particularly in gold, Turkey's leading mineral resource. In 2000, Turkey had no gold production but, by 2015, it had become Europe's leading gold producer. Seven gold mines were built in this time, and all by Turkish construction companies.

However, foreign mining companies, particularly from Canada and Australia, have been key to Turkey's success, especially after a revision to the mining law in 2010, which made Turkey a foreign friendly mining jurisdiction. "Thanks to foreign mining companies we now have more skilled mining professionals and technical persons in Turkey. Turkey has become the biggest gold producer in Europe because of foreign investment and it benefits greatly from mining activities and operations," remarked K. Soner Koldas, country director at Pasinex, which has discovered the richest zinc deposit in the world in terms of grade near Adana, southern Turkey.

Shifting dynamics: from foreign to domestic capital

However, once the darling of foreign investors, there has been a substantial decline in positive sentiment towards Turkey's mining regime. According to the Fraser Institute's 2016 annual survey of mining jurisdictions, Turkey fell in the

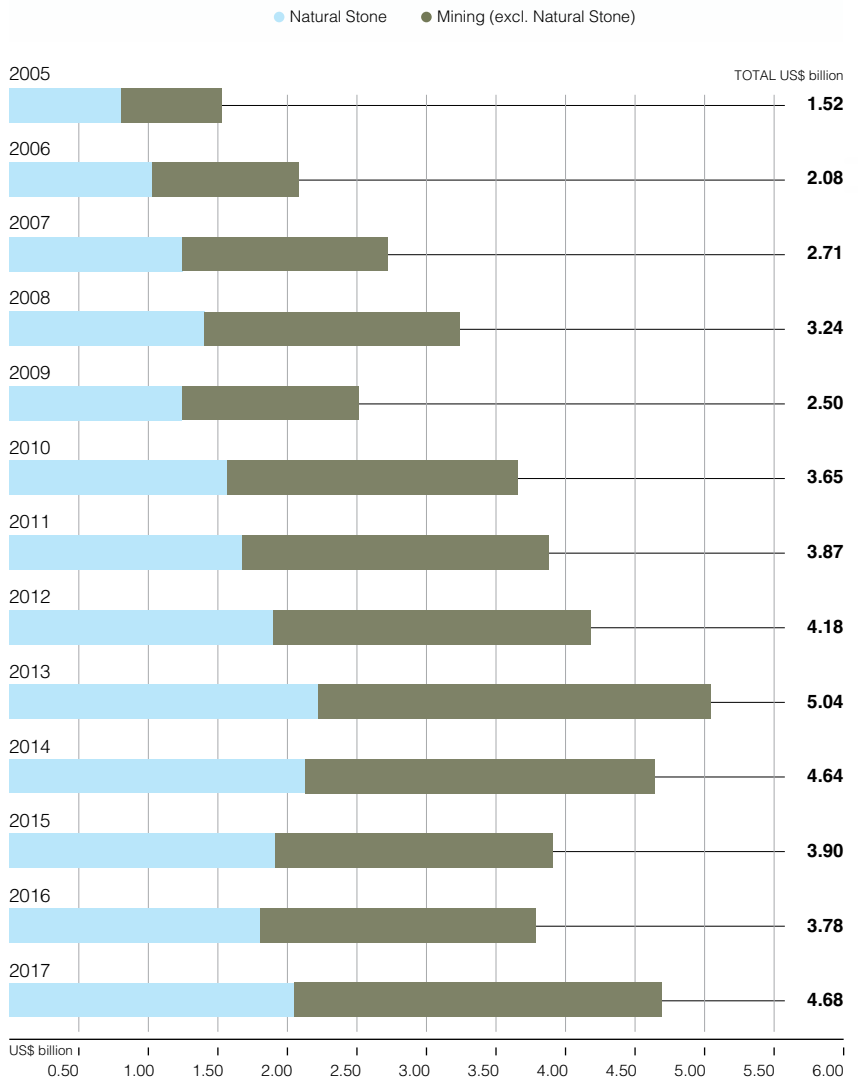
Institute's policy perception index, from 49th position out of 105 jurisdictions in 2015, to 72nd out of 110 jurisdictions in 2017.

A key reason for this fall in the rankings has been the challenges experienced in obtaining permits, emanating from a decree in 2012, which stipulated that any applications to use governmental lands must go through the prime minister's office. "The situation has not changed, and it is one of our main challenges as, without a permit, you cannot do drilling and expand your mining operation. It used to take a couple of weeks but now it takes years; it is a terrible situation and we hope that it will change after the elections in Turkey in June 2018," remarked Koldas.

Furthermore, investors must handle a dizzying array of permits and licenses – 20 at last count. These factors, along with lower commodity prices, have dampened both exploration and foreign investment into Turkey's mining industry. Nevertheless, there has still been much activity in the industry over the last few years. As Nezh Doğu, country manager of testing

TOTAL VALUE OF MINING EXPORTS

Source: IMMIB



and analysis provider Bureau Veritas, remarked: “Our industry does not necessarily depend on foreign investment. There are serious local players in the field with considerably important projects. Turkey has much mining potential and it has a skilled labor pool.”

While the industry has seen a decline in foreign investment, there have been large domestic investments, representing a shift in the sector’s dynamics compared with the last decade. Contrary to what some foreign investors might believe, the permitting challenges do not indicate that the government sees the industry as any less important than before. “The government is giving much more priority to mining overall. Also, two years ago, the government changed its mining strategy and coal mining has been given a lot of support. Banks are now giving more credit to coal projects and some coal mines have moved to the construction stage. Construction companies have much capital and have been investing a lot in mining. Also, due to new laws, large scale mining has been incentivized,” explained Güven Önal, president,

Image courtesy of Epiroc



22 Turkish Mining Development Foundation. Coal is highly strategic for Turkey as it forms a key element of the government's efforts to reign in energy imports and thus help decrease Turkey's chronic current account deficit. Four coal power plants are currently under construction, with two built recently by Sabancı in southern Turkey, and another by Aksa Enerji in the Bolu province in the northwest. Turkey's coal industry faces challenges, however, as generally Turkish coal is of very low calorific content, and there is an urgent need for technical expertise to get the most out of Turkish coal.

Important large-scale, domestically financed projects in other areas have also been announced recently, including Cengiz Holding's US\$1.1 billion investment in southeast Turkey, close to the Iraqi border, in the Mazıdağı phosphate complex. Cengiz has benefited from tailor made government incentives for this project. The complex will make different types of fertilizers and Cengiz will also recover copper, gold, cobalt and nickel from the project. Also, Ciner Group has announced a US\$1.5 billion investment in a trona solution mine in Kazan, near Ankara. The project will meet 14% of the world's natural soda ash consumption, making Turkey the world's largest

producer, and export volumes are expected to reach US\$600 million per year.

Turkish gold still shines

Turkey, and Anatolian civilizations before it, have long had a love affair with gold, stretching back to the time that merchants pioneered the use of gold coins in ancient Lydia. Today, gold plays an important role in Turkish cultural and economic life, being used in weddings as a medium of exchange, often in jewelry, but also as a unit of account. For example, in Istanbul's famous Grand Bazaar rents are often priced in gold. Furthermore, gold plays an important part in Turkey's financial system and, at the end of 2013, commercial banks held approximately 250 metric tonnes (mt) of gold, equivalent to US\$10.4 billion. Overall, Turkey is the fourth largest consumer of gold in the world. In terms of its own resources, total workable gold reserves in Turkey stand at around 840 mt but geological estimates suggest up to 6,500 mt. However, gold mining's potential has been curtailed by permitting challenges, which have subdued exploration activity in the last few years. "Nowadays, more demand is coming from existing companies ex-

panding their projects, big projects reaching the development phase or projects seeking international finance. The major companies and projects are doing well, and they continue to invest," commented Serhat Demirel, operations manager, Golder Associates.

Indeed, existing gold miners have been busy in the last two years. For example, Öksüt Sanayi ve Ticaret Madencilik, a 100% owned subsidiary of Canadian based Centerra Gold, started construction of its gold mine in the Kayseri province in March 2018. The deposit holds approximately 1.2 million ounces of gold, which will be mined and stacked over a mine life of eight years from two open pits – the Keltepe pit and the smaller Güneytepe pit. Meanwhile, Anagold Madencilik (a JV between Canadian Alacer Gold and Turkish Lidya Madencilik), which owns the Çöpler gold mine, the second largest gold reserve after Tüprağ's Kışladağ project, has embarked on a major expansion project. Along with its open-pit, heap-leach operation that produced gold from oxide ore, the Çöpler deposit also possesses refractory sulfide ore that requires a different processing solution. Anagold completed a definitive feasibility study in June 2014, which recommended the treatment of the

sulfide ore via pressure oxidation and, in May 2016, construction started on the project, with first gold pour in Q3 2018. There have also been some ownership changes including Tümad Madencilik (Nurul Holding)'s acquisition of the Lapsecki project from Australian company Chesser Resources in 2014. The project has a low sulfidation vein system and is now in production. Tümad also has a mine license of 73,950 million m² for or the Balıkesir İvrindi project, which is now at investment stage and based on the feasibility study has 600,000 oz of gold reserves.

Alongside the construction projects of Öksüt and Anagold, there are some highly promising development projects waiting for lift off. For example, Canada-based Alamos Gold has completed positive feasibility studies for the Ağı Dağı and Kirazlı projects in the Çanakkale province on the Biga Peninsula. Both projects are expected to be stand-alone open-pit, heap-leach operations, with Kirazlı expected to produce an average of 104,000 oz/y of gold over a five-year mine life and Ağı Dağı 177,600 oz/y over a six-year mine life.

As of July 2018, Alamos Gold has received all permits to start development of Kirazlı. "We are very pleased to have achieved this key milestone. With the Environmental Impact Study and Forestry Permits having been previously approved, we have all the required permits to ramp up full scale construction activities. As one of the lowest-cost and highest return gold projects in the world, Kirazlı will be a significant driver of free cash flow growth with initial production expected in 2020," said John A. McCluskey, president and CEO, in a press statement.

Another project of Alamos', Çamyurt, has predicted 93,200 oz/y of gold potential over a four-year mine life, according to a preliminary economic assessment in 2017. These projects suggest there is still much untapped potential for Turkey's gold industry. As Erdem Tüzünalp, regional general manager, Turkey and MENA at Epiroc, summarized: "We still do not have a high enough level of exploration and there are social and environmental problems which means it is difficult to obtain permits. We know there are a lot of gold reserves."

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Murat Güreşçi

General Manager and
Board of Directors Member
ÇAYELI BAKIR

“ We want to leave a reasonable legacy by generating some socio-economic activity following the mine closure. First Quantum Minerals, our mother company, is sensitive to local communities and our employees' needs, therefore we are actively engaging with them to design a widely accepted project. ”

How has Çayeli Bakır been able to increase reserves at the Çayeli mine?

We have not explored a new ore body, but we have managed to add further ore to our reserves by doing diamond drilling in the current ore body. This allowed us to extend the life of our mine. Our new mine life now goes until the end of 2022.

What is the extent of Çayeli Bakır's current exploration program in Turkey?

In previous years we evaluated the results of the soil sampling program we had done and did some drilling on the targets that the program indicated. However, we could not manage to define a new ore body. At present, we have a new exploration program going on, based on a new geophysical survey. We will initiate a diamond drilling campaign if the geophysical results are positive.

In 2015 Çayeli Bakır received a Leadership Award for Sustainable Mining from the Mining Association of Canada (MAC). What have been the success points of Çayeli Bakır's sustainability program?

There is a lot of effort and hundreds of compliance and performance indicators behind this award. We have been measured against numerous criteria, including social, environmental, health, safety and human rights standards. Çayeli Bakır has an open-door policy at our External Relations office in Rize - we want to be accessible for our communities. We are happy to listen to their concerns and address them satisfactorily. We actively engage with stakeholders, build capacity at the nearby communities and cooperate with the authorities. Most of our social funds are managed by a board which consists of our stakeholders, and Çayeli Bakır has just one vote out of nine. This is a great example of good governance. Such practices are strengthening our position and building trust among stakeholders. Moreover, safety is a core value at Çayeli Bakır - nothing is more important. We introduced the “Compulsory Stoppage of Hazardous Work” policy years ago. Our “Life Saving Rules” are also one of the key practices to visualize high potential hazards and prevent incidents. We have achieved 587 lost time injury free days because of our programs. Similarly, we implement a “zero discharge” policy to minimize our footprint on our beautiful Rize and eastern

Black Sea Region. We have reduced our waste significantly due to awareness raising sessions; on average, annual CO₂ emissions have fallen by 13% over ten years.

What should companies with underground mines do to improve their safety record?

The management team's commitment to safety is one of the key elements in ensuring a safe work environment. Leadership is vital, and not many people would take safety so seriously unless management set high standards, put in place policies and procedures and track safety performance. Mining companies should also pay attention to the correlation between good safety performance and productivity. At Çayeli Bakır, the highest production periods match with our good safety performance. There is a business case in investing in safety.

How will Çayeli Bakır manage the effect on the local community once the mine closes?

We have started planning a smooth mine closure. We want to leave a reasonable legacy by generating some socio-economic activity following the mine closure. First Quantum Minerals, our mother company, is sensitive to local communities and our employees' needs, therefore we are actively engaging with them to design a widely accepted project. The initial consensus is to transform our mine site into a tourism attraction, and we have had some initial designs. However, we still have four years and we may revise the project in consultation with the stakeholders.

What are Çayeli Bakır's core objectives up until 2022?

We want to continue our operations safely and remain a steward to the environment, while maintaining our good relations with stakeholders, particularly the communities. We want to keep and even strengthen the positive reputations of both Çayeli Bakır and First Quantum Minerals through high quality social, environmental and safety performance. First Quantum Minerals would like to operate in Turkey and is willing to invest more if further decent mining opportunities appear.

We have talented employees and want to transform our experience, expertise and corporate culture into other operations in Turkey whenever possible. ■

Image courtesy of Epiroc



Getting the Turkish public onboard

All over the world, gold mining has faced public relations challenges, primarily because of the use of cyanide in the processing of gold. Public opposition has been particularly fierce in Turkey, reflecting the still very new nature of gold mining in Turkey, as well as the country being relatively densely populated. The experience of Tüpraş, one of Turkey's most respected mining companies, is indicative of the difficulty gold miners face, despite risks of cyanide contamination being very low. The company has had to conduct repeated environmental impact assessments (EIAs) for its Efemçukuru and Kızıldağ prospects before getting approval due to court interventions.

The industry has gradually learnt the techniques of successful public relations management, showing that it is possible to get the Turkish public on board with gold mining. Nevertheless, public perception is still one of the greatest risks gold miners face. To assuage public concerns, Tümad organized trips for locals near their Lapseki project to Koza Mining Company's Bergama Ovacık gold mine, as well as Tüpraş's Efemçukuru gold mine. Bergama was the site of intense public opposition in the 1990s, including an invasion by 4,000 villagers in April 1994, and the mine was

forced to close due to protests between August 2004 and May 2005. "Bergama is a very sensitive area due to the existence of high quality agricultural production there, such as olives, as well as seven or eight villages and the highway to Izmir being close. Therefore, it is a good example study on the environmental impact of gold mines, which is none. There is a conventional tailings dam with very low concentrations of cyanide. So, once we took people there, it helped a lot," explained Cem Yuceer, coordinator, Tümad Madencilik. Recently, gold mining in Turkey has been supported by international financial organizations such as the European Bank for Reconstruction and Development (EBRD) and UniCredit Bank, which has helped underpin high standards for the management of social and environmental risks. With the help of the EBRD and two Turkish banks, Tümad has managed to secure a US\$200 million credit facility for the İvrindi and Lapseki gold projects and Centerra Gold has received a US\$150 million project financing term loan facility for the Öksüt project, with backers including the EBRD and UniCredit. As part of the financing for Öksüt's project, biologists visited their project to identify endemic species and now there is a preservation program involving the collection of seeds and planting them elsewhere.

"Typically, when companies do EIAs, they should conduct a public participation meeting and include some social information to the EIA report, but social impact assessment is not regarded as important in Turkey, so the country is lacking in this regard," according to Demirel. "When we do gap analysis we find the missing elements are mostly acid rock drainage, groundwater impacts assessment, social studies and biodiversity studies," Demirel continued, highlighting how norms in Turkey still fall short of international standards.

A maturing industry seeks to get back on track

Overall, while Turkey's mining industry was in its infancy from 2000 to around 2014, it has now reached its adolescent years. There may have been growing pains along the way, but Turkey's industry is maturing and looking to the future. Permitting challenges notwithstanding, the government has put in place some highly attractive incentives for foreign investors. These differ depending on a region's poverty level, with certain regions having more advantages. Companies can deduct part of their capex from future revenues and royalties are adjusted with respect to commodity prices; a helpful measure to mitigate against price volatility. Turkey has also designed a scheme to provide tailor-made incentives programs for any investments over US\$100 million.

For miners, Turkey can still be the land of the possible. Speaking of Tümad's Lapseki project, Yuceer commented: "From November 2014 to end of December 2017, we completed the environmental impact assessment, all permitting (such as forestry and construction), detailed feasibility, financing and construction and started pouring gold. This should stand as a message to potential domestic or foreign investors of what can be achieved in a short time period. Permitting need not be the main barrier, provided it is managed well."

There is also widespread acknowledgement that the government is listening to the industry's concerns about permitting and hope that the situation is now improving. "I am bullish on the future for mining in Turkey. We have a pro-mining government and support from mining department MI-GEM," summarized Koldas of Pasinex. ■



Mehmet Yılmaz

Chairman of the Board of Directors
TÜPRAG METAL MADENCİLİK

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Kışladağ brings job opportunities to the doorsteps of local villagers and the community, and royalty payments directly to the province. Kışladağ is also a very good indicator of Turkey's attractiveness for foreign investment.

Could you please provide an update on the latest developments at Kışladağ, in particular the expected construction of a conventional carbon in pulp mill?

The mill project was approved for advancement by the Board of Directors of Eldorado Gold Corporation, Tüprag's Canadian-based parent company, in late October 2018. It is an estimated US\$520 million investment, which includes US\$384 million for the mill, US\$75 million for pre-stripping and US\$61 million in contingency and growth allowance. Current proven and probable reserves of 3 million ounces of gold support a nine-year mine life, with average annual production of 270,000 ounces of gold at an all-in sustaining cost of US\$793 per ounce.

Kışladağ is Turkey's largest gold mine and is emblematic of the country's rise in gold mining. What are the benefits of gold mining for Turkey?

One of the benefits of gold mining for Turkey is the positive effect on job creation and generation of economic value. Kışladağ, in particular, brings job opportunities to the doorsteps of local villagers and the community, and royalty payments directly to the province. Kışladağ is also a very good indicator of Turkey's attractiveness for foreign investment. It shows that foreign investment can be successful if you work to international standards, protect human rights and give back to local communities.

What are the strategic objectives for Efemçukuru in the longer term?

Efemçukuru is also an important project for Eldorado Gold in Turkey. We expect to achieve the 90,000 to 100,000 oz target in 2018 within our budget guidance. We have assigned some capital to enlarge the waste rock area, which has been fully permitted, and also to the dry tailings facility. We are also making other investments to improve technology.

Generally, our strategic target for Efemçukuru is to continue our track record of safe, responsible, and profitable operations. Efemçukuru is in a very picturesque location in the western side of Turkey, close to the sea and in the middle of a forest, so we are highly motivated to operate to the highest environmental standards. We have an

excellent environmental track record. We also have very good public and government relations. We will continue to foster these relationships with key stakeholders, fulfill all permitting and regulatory requirements, while focusing on achieving the production figures we have set out for ourselves.

A social license to operate is especially important in Turkey. What are the most important aspects of Tüprag's engagement strategy with the public?

Tüprag paved the way for best practices in gold mining in Turkey. A company can employ the best engineers, construction partners and staff, but the most important thing is to have good community and government relations. We believe that a company can obtain all the permits from all the legislative stages, but it must also get the social license from the local communities. A company must keep lines of communication open, to inform the local community about what has happened, what is happening, and what will happen in the future.

It is very important to have excellent communication with people so that those working around the mine site really feel that it is their mine. To achieve this, our target is to employ 80% or more of our workforce from local areas. This gives a lot of ownership and possibilities to individuals from surrounding communities.

Equally important is having a good reputation and fulfilling all regulatory responsibilities. We have various CSR projects that promote environmental activities, education, public health and rural infrastructure. These help to create credibility in the eyes of our local neighbors. Finally, transparency is also important; we conduct tours of our mine sites so visitors can see what is going on and ask questions. We always say, "first people, then environment and then mining."

Could you summarize Tüprag's vision for the coming few years?

Tüprag is always looking for new projects in Turkey which could add value to our portfolio. We are proud to have a very experienced team, and we have an extensive database on Turkey, so we believe that there is potential for Tüprag to work on new projects. We really believe that Turkey is very geologically prospective. ■



Cem Yuceer

Coordinator

**TÜMAD MADENCILIK
(NUROL HOLDING)**

We have a policy to employ young people, and Tümad will be the sponsor of three high schools in different parts of Turkey focused on mineral resources and renewable energy. The graduates of these schools will be employed in the mining and energy sectors.

Could you give an overview of Tümad's İvrindi and Lapseki projects?

Tümad has mineral exploitation licenses of 7,400 ha for the Balıkesir İvrindi project, which is now at investment stage and 1,500 ha for the Çanakkale Lapseki Project. Based on the feasibility studies, İvrindi has 600,000 ounces (oz) and Lapseki has 400,000 oz. Project financings for both projects have been completed, for an approximately US\$400-million credit facility.

We are now in production at our Lapseki project, which is a low sulfidation vein system, acquired from Australian company Chesser Resources in 2014. From November 2014 to the end of December 2017, we completed the environmental impact assessment, all permitting (such as forestry and construction), detailed feasibility, financing and construction and started pouring gold. This should stand as a message to potential domestic or foreign investors of what can be achieved in a short time period.

How did Tümad succeed in implementing the Lapseki project whilst other projects have been delayed?

The number one reason is open and sincere communication with the government, through regular meetings with them, as well as with the locals. It was important to show our intentions and vision clearly about using the highest available standards and gaining a social license to operate. It is a real team effort and it has been a phenomenal achievement.

We also organized trips for the locals to the Bergama and Efemçukuru gold mines. Bergama is a very sensitive area due to existence of high quality agricultural production there, such as olives, as well as seven or eight villages and the highway to İzmir being close. Therefore, it is a good case study on the environmental impact of gold mines, which is none. There is a conventional tailings dam with very low concentrations of cyanide. So, once we took people there, it helped a lot.

Why do companies like Tümad join the International Cyanide Management Code?

This helps show people how serious a company is about managing cyanide, which is an easy to manage chemical. Having this

code gives us more confidence in moving the project forward.

Part of EBRD's financing for the two projects is a comprehensive CSR program. Could you give us more details about it?

We have a policy to employ young people, and Tümad (part of Nurol Holding) will be the sponsor of three high schools in different parts of Turkey focused on mineral resources and renewable energy. The graduates of these schools will be employed in the mining and energy sectors, which will help to fulfill the need for technicians. As part of the government's wider initiative in this area, there will be 12 or 13 high schools like these ones. We have a definite plan to use labor from the nearby villages in our mines.

How does Tümad intend to expand its portfolio of projects?

Tümad has a highly experienced and capable exploration team which will be seeking new opportunities. We believe that Turkey is still an underexplored country and we are dedicated to find more interesting properties. There will be upcoming auctions for mineral tenements in a few months. The MTA has a 2 million-meter drilling target for this year, so there will be auctions of the grounds resulted from these efforts with decent work and possibly resource on them, such as coal, gold and base metals. Plus, we have some existing tenements in northern and western Turkey. Our whole crew has been focused on our two main projects but very soon we will distribute them to new tenements so they can find new İvrindis and Lapsekis.

Is Tümad considering diversifying from gold projects to base metals?

Yes, but it depends on what commodity is "shining" in the future. Now it is gold and for a foreseeable future it seems to be so. In the long-term, our vision is to become one of the best producers in the world. In the short term we aim to produce 150,000 oz/y. Aside of gold, we could also diversify our focus to specialty minerals like lithium, cobalt and nickel. Nurol Holding also has technology companies in its portfolio. So, we may develop end-product oriented business models starting from the extraction of mineral commodities in the future. ■



Hasan Yücel

President
TURKISH GOLD MINERS ASSOCIATION

Turkey's gold mining industry has grown rapidly since 2000, becoming Europe's largest gold producer. How has the gold mining industry performed in the last few years?

We experienced a great leap in the years from 2000 up to 2013 – from zero gold production to 1 million ounces per annum. From 2013 the boom ended and there was a downturn because of the hurdles in the permitting regime, with one of the main issues being the very high forestry fees, which drastically slowed down investments in expansions and new gold mines. Therefore, in 2017 our production was around 24 mt/y, lower than the 33 mt/y we achieved in 2012 to 2013. There are projects in the pipeline, but they have stayed as highly developed brownfields due to these issues, for example Halılağa in western Turkey, the Öksüt project (which has now got approval, but they should have received it a couple of years ago), and Polimetal Madencilik's Gediktepe project.

Turkey's potential is much higher than this, given we have a capacity of 60 mt/y to 70 mt/y. We believe there will be an improvement in the permitting regime. Also, aspects like the July 2016 coup attempt did not help the investor climate. Turkey is a developing country, including with respect to the mineral industry, and there is a re-

structuring and improvement underway of the Turkish mining bureaucracy, including new regulations, codes and incentives. These things will take time to have effect, however.

How does the Turkish Gold Miners Association work with the Turkish government to solve issues like the permitting problems?

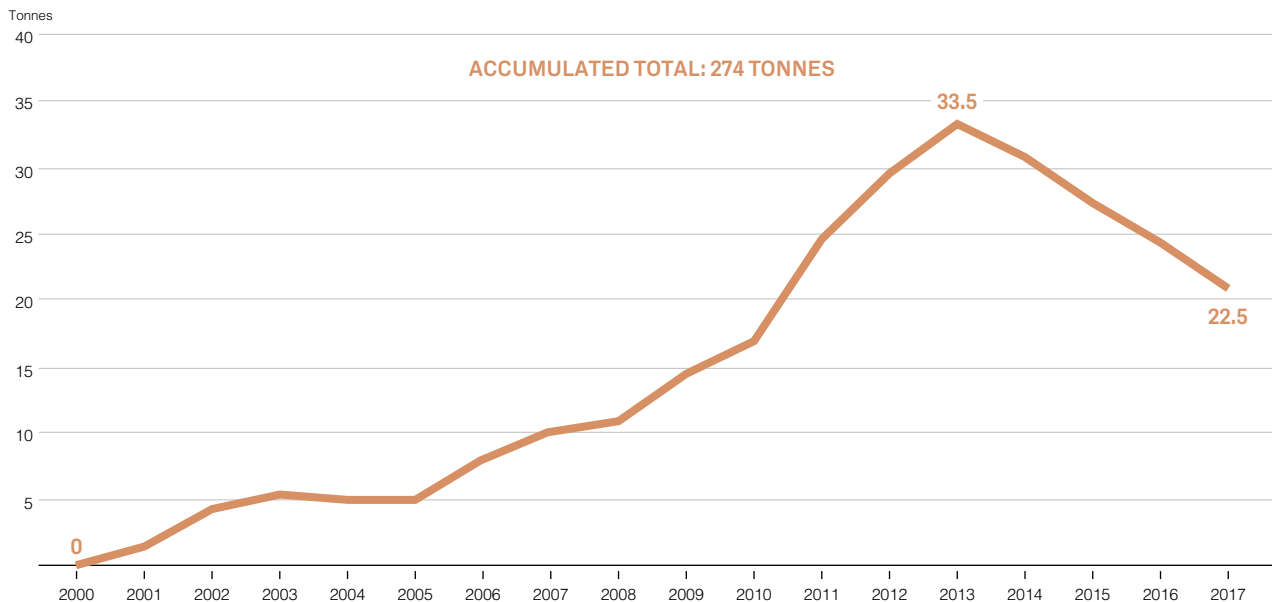
We have a great dialogue with mining policy makers, and I myself have come from the government so I have a good relationship with them. The opinions of the gold mining industry are well received within the government. The Turkish Gold Miners Association utilizes the highest standards for mineral exploration and exploitation, environmental matters and health and safety. Therefore, we are an example for other sectors within the mining industry in Turkey.

What would your message be to international investors about the mining policy regime in Turkey?

We are an investment friendly country and while there may have been some hurdles in the past, there are ongoing fundamental reforms to the mining sector and economy in Turkey, including the introduction of more incentives for investors. ■

TURKEY'S GOLD PRODUCTION (2001 - 2017)

Sources: Turkish Gold Miners Association





Güven Önol

President

**TURKISH MINING
DEVELOPMENT FOUNDATION**



We still have problems with the mining law. For instance, if you want to sell more than 10% of a company, you must get permission from the government.

Also, applications for mining licenses must go through the Ministry of Energy and Natural Resources. This has affected foreign investment.



Could you provide the highlights of the Foundation's activities since 2014?

The most important decision taken was to have automatic retirement for our board members who are over 80 years or older. Now the board is much younger as seven members retired at the end of 2017. The Foundation has also been organizing a lot of international congresses and technical visits to other countries and different locations in Turkey. For example, in 2017 we organized the INERMA congress and exhibition, which stands for the International Energy Raw Materials and Energy Congress, in cooperation with Istanbul Technical University.

With the university's mining faculty, we also organized a congress on Balkan mineral processing held in Antalya, which had many attendees from Balkan countries. We also organized technical trips to Germany, Sweden and Finland, that 28 mining professionals attended. Furthermore, we delivered a Mining Master Plan for the next 20 years to the Ministry of Energy and Natural Resources. We are also organizing television programs to improve the image of mining, with episodes every 15 days on Bloomberg TV and every month on Cemtv.

Where are there most opportunities in Turkey's mining industry?

The government is giving much more priority to mining overall. Also, two years ago, the government changed its mining strategy and coal mining has been given a lot of support. Banks are now giving more credit to coal projects and some coal mines have moved to the construction stage. Construction companies have much capital and have been investing a lot in mining. Also, due to new laws, large scale mining has been incentivized. For example, Cengiz Holding are investing about US\$1 billion in south-east Turkey, close to the Iraqi border, in a phosphate complex to make different types of fertilizers. During sulphuric acid production, they get iron oxide which is going to their leaching operation from where they recover copper, gold, cobalt, nickel etc. The complex is coming into operation this year.

Two coal power plants have been built, one by Sabancı in southern Turkey, and another by Aksa Enerji in the Bolu province in the northwest. Four more coal power plants

are under construction, which shows the scale of investment into coal. The biggest investment recently has been made by Ciner Group which invested about \$1.5 billion in solution mining in Kazan near Ankara. They will produce 2.5 million mt/y of natural soda and have expanded capacity at their Beypazari mine by 500,000 mt/y. Many gold mines have also been put into operation, with 13 mines now running and six under construction. About ten gold and silver mines are in the exploration phase. There are also some investments into copper and chromite mines, with a larger investment in a copper mine in the Kastamonu area. In two or three years all these mines should be operational. Mineral exports are now about US\$5 billion; however, in the last decade most demand has been domestic and exports are not growing as strongly.

How challenging is the mine licensing and the environmental, health and safety regulations setup in Turkey?

We still have problems with the mining law. For instance, if you want to sell more than 10% of a company you must get permission from the government. Also, applications for mining licenses must go through the Ministry of Energy and Natural Resources. This has affected investment by foreign investors as they do not want to take on the risk and generally new capital from abroad is not coming. Domestic capital, on the other hand, is increasing due to the government's support.

After the Soma mine disaster, have safety standards improved at Turkish mining companies?

After the accident everything changed, including the mining law. For example, board members at mining companies are now responsible for accidents. This has meant mine owners are not putting themselves on boards and foreign investors either do not invest or make their domestic partner cover the risk. We are trying to change this aspect of the law.

What are the Foundation's main priorities going forward?

We are currently preparing for the next Eurasian International Mineral Processing Congresses in 2019 and 2021. ■

a national energy policy, which pushes for an increase of domestic resources, especially coal which currently makes up 30% of electricity generation. Overall, the aim is to reach 65% of energy consumption being from domestic sources.

Therefore, coal is a highly strategic resource for Turkey. In line with the government's overall privatization drive for the Turkish economy, coal has gradually been privatized over the last ten years. Mine licenses are auctioned off to private companies which are then required to build power plants. A coal project deemed strategic enough for the country's energy needs can be exempted from corporate taxes and tariffs. Potentially, they can also lease state land for free and receive a 50% discount on electricity bills, as well as state funding for wage subsidies, insurance premiums and interest on investment loans. Additionally, the government has offered a guaranteed €0.05 per kWh coal-generated electricity price and a commitment to buy 6 billion kWh of coal-generated electricity per year. In the last four years, two coal power plants have been built, including one by Sabanci in southern Turkey and another by Aksa Enerji in the Bolu province in the northwest. Four more additional coal power plants are under construction. "The government is pushing a handful of very big coal power plant projects, and wants to ensure all the mined coal comes from Turkey as it seeks to reduce energy imports from Russia and CIS countries. The new power plants and mines feeding them will all be finished in the next five years," explained Ulrich Ruppel, deputy general manager, DMT Turkey Branch.

Also, in October 2018, the Ministry announced that it was transferring seven coal fields, totaling 203 million mt of reserves, to private players. Four lignite fields have



been transferred from Turkey's state lignite mining company *Türkiye Kömür İşletmesi* (TKİ) to *İmbat Madencilik*, *Fernas* holding, *Demir Export*, and construction group *Yapı Tek*, while three hard coal fields were transferred from Turkey's state owned hard coal mining company *Türkiye Taskömur Kurumu* (TTK) to *Erdemir Madencilik*, *Tumas*, a subsidiary of Turkey's *Bereket Holding*, and energy company *Emsa Enerji*.

Incentivizing coal

Turkey even has compulsory land acquisition and resettlement laws which have been applied to enable private companies to move ahead with a project if it is deemed by the inter-ministerial council to have significant public benefits. For example, this process was used ahead of the construction of the 450 MW capacity *Tufanbeyli Thermal Power Plant* in the *Adana* province, completed in 2016, and is being used for the new coal reserves apportioned to the 420 MW capacity *Yeniköy Thermal Plant*. Furthermore, the government has launched a policy of combining coal licenses to create large-scale projects. For such projects,

the government gives companies a 50% discount on forestry fees, a significant benefit given that Turkey has some of the highest fees in the world.

To increase the country's coal reserves, Turkey's General Directorate of Mineral Research and Exploration (MTA) has been carrying out an extraordinarily busy drilling program. The MTA commissions private contractors to do the drilling. "In the last two years, we have been taking such measurements all over Turkey for the MTA which has an extra 1 million-meter target for each year. This is highly significant given that in the preceding 70 to 80 years the MTA only did 1.5 million meters of drilling," remarked *Mustafa Bayar*, general manager, *BAYAR Industrial Services and Plants Mechanical Manufacturing Trade and Plants Mechanical Manufacturing Trade* (*Bayar*). "There are more than one billion mt of lignite coal in the *Konya* and *Karaman* provinces according to our results, and the same amount in *Thrace* near *Bulgaria* and *Greece*. Additionally, we have found 250 million mt of coal in the *Eskişehir* province."

The MTA met its 1 million-meter drilling target in 2017 and is expected to complete 1.6 million meters of drilling in 2018.



Turkey produced

78.9

million tonnes of raw coal in 2017

including

1.8

million tonnes of hardcoal

and imported

36.6

million tonnes of hardcoal

Source: TurkStat



Turkey imports coal to power

11

operational thermal power plants

totalling

8.79 GW

19

million tonnes of coal

would be produced with the new privatized fields

Source: Ministry of Energy and Natural Resources

Getting the best out of Turkish coal

For such ambitious plans one would presume Turkey is endowed with high quality coal resources. This could not be further from the case. “Compared to international standards, geology has not been very kind to Turkey, as in the United States, Australia and China there is 5,000 to 7,000 kilocalories per tonne of hard coal with undisturbed seams that go in one direction for kilometers. Only in the Black Sea region is there hard coal at 4,000 to 6,000 kilocalories but the mines there, owned by state-owned company TTK, use very difficult fully mechanized longwall mining due to the tectonical structure of the seams,” explained Ulrich Ruppel, Deputy General Manager, DMT Turkey Branch. “All the other coal reserves are lignite, except in Soma where there is hard lignite and the quality is in the range of 2,500 to 3,500 kilocalories - still poor compared to international standards. In Elbistan, the coal has typically 1,000 to 1,500 kilocalories per tonne only, and has much sulfur and water content.”

The poor quality of Turkey’s coal reserves means that, to get the best quality available, miners must dig very deep underground, which has driven demand for international expertise. “We are representing China Coal Construction Group (CCCG) because surface mines and ores are almost completed in Turkey and we must go deeper,” commented Bayar.

His company has worked with CCCG to deepen the mine shaft at a Zonguldak mine, owned by state-run Turkish Hard Coal Company (TTK), from 360 meters to 850 meters with a 6.5-meter diameter. “CCCG can move a shaft four meters deeper every

day, meaning a shaft of 1,600 meters can be completed in approximately one year,” continued Bayar.

DMT, headquartered in Germany, has worked with Polyak Eynez Mining Company in the Soma area of Turkey and a Chinese shaft sinking contractor, helping them with mine planning, gas calculations, rock mechanical engineering and support for their vertical shafts and drifts. “It will be a hard lignite coal mine and the deepest in Turkey, and they will mine with the long-wall top coal caving method (LTCC) at a depth of 900 meters to 1000 meters,” said Ruppel.

There is also an open question about the extent to which high quality standards are being followed in the Turkish coal mining industry. On the one hand: “The state-owned companies, the General Directorate of Mining Affairs and the Ministry of Energy have all said they absolutely want to abide by international standards for resource/reserve evaluation,” said Vehip Kaci, general manager, DMT Turkey Branch.

On the other hand, junior companies are known to buy a mining license before investing in international reporting. Furthermore, there are few internationally certified laboratories for handling samples in Turkey, especially for coal.

Generally, Turkish coal has an acute image problem. No one can forget the tragic events of the Soma mine disaster. This has undoubtedly tainted the reputation of coal mining in the country – a survey by Climate Home in 2018 found that 83% of Turks supported renewables over coal as a source of energy. Indeed, the coal industry must also overcome its doubters from a climate change perspective, especially given that according

to the same survey 86% believe that climate change is happening and a higher proportion are “very worried” or “extremely worried” compared with the European average.

Environmental regulation covering mining has become more sophisticated in Turkey in recent years, but for coal mining it still lags international standards. A common practice in most mining jurisdictions, regulations on acid rock drainage have now made their way to the country. A new regulation on mine waste was introduced in 2015 and finally confirmed in 2017, although the government has excluded coal ash from it.

“Before, even heap leach facilities were not covered by mining regulation but now they are along with tailings facilities and waste rock dumps. Critically, if waste truck dumps have acid rock drainage or metal leaching potential, companies must create a design report and submit this to the Ministry of Environment and Urbanization, to show how the contact water will be managed. Only after the Ministry’s approval can facilities be constructed, or any waste dumped,” remarked Serhat Demirel, operations manager, Golder Associates. “The regulation also includes the development of a waste management plan together with a risk assessment, a categorization of the facilities, and a financial guarantee. This reflects a greater understanding by the government and the industry. NGOs are also becoming more educated on the subject as well.”

Grand ambitions and the future of Turkish coal

The scale of Turkey’s plans for the coal industry are enormous; in fact no other coun-

tries plan to build as many coal-fired power plants as Turkey does, except China, India and Vietnam. Whilst Vietnam has a similar size population to Turkey (96 million to Turkey’s 81 million), China and India are vastly bigger. Such plans have shaken up the mining industry in Turkey, particularly the services and equipment sector. “In Turkey, we believe our future lies in gold, coal and base metals,” remarked Murat Us, Middle East and Turkey sales coordinator, FLSmidth.

Turkey is notching up successes in its pursuit to produce more coal. Domestic coal production was expected to be 80 million mt/y in 2017, according to the Ministry of Energy and Natural Resources. Nevertheless, imports of coal remain stubbornly high and have actually grown from 25 million mt in 2013 to 30 million mt in 2018. Partly, this reflects Turkey’s growing energy needs, as it has had the highest growth in energy demand out of any OECD country from 2001 to 2016, but it also suggests grand ambitions are not quite being realized.

Even though the government provides generous subsidies, it may have to do more to ensure it reaches the goals it has set for Turkey. “Firstly, clean coal technologies should be employed to reduce public opposition to coal projects in local areas,” commented Bayar. “Also, the government does not have thorough planning in place to increase production, but rather has a privatization policy for mine rights and private companies then sell coal the Electricity Generation Company (EÜAŞ). Furthermore, the government does not want to invest money into the sector but at the same time requires private companies to build power plants if they own mine rights.” ■

Vehip Kaci & Ulrich Ruppel

VK: General Manager
DMT TURKEY BRANCH
 UR: Deputy General Manager
DMT TURKEY BRANCH



VK



UR

DMT was working on 10 coal projects in 2014 and had 18 exploration projects in the pipeline. Could you provide a case study of a project you have worked on since then?

UR: One of the biggest projects we have worked on is the coal project of Polyak Eynesiz Mining Company in the Soma area of Turkey. We have been working with them for the last five years and have helped them with mine planning, gas calculations, rock mechanical engineering and support design for their vertical shafts and drift. We then went with them to China to assess the technical capabilities of Chinese shaft sinking contractors. Both vertical shafts are now sunk and the Chinese contractor is still working on the site on other roadway developments. DMT's current task is to upgrade Polyak Eynesiz's coal resources. It will be a hard lignite coal mine and the deepest in Turkey and they will mine with the longwall top coal caving method (LTCC) at a depth of 900 meters to 1000 meters.

Coal is of strategic importance to Turkey given it is aiming for energy self-sufficiency. Are you seeing much demand from this sector of the mining industry?

UR: The government is pushing a handful of very big coal power plant projects, and wants to ensure all the mined coal comes from Turkey, as it seeks to reduce energy imports from Russia and CIS countries. The new power plants and mines feeding them will all be finished in the next five years.

Yet, geology has not been very kind to Turkey, as in the United States, Australia and China there is 5,000 to 7,000 kilocalories per tonne of hard coal, with undisturbed seams that go in one direction for kilometers. Only in the Black Sea region is there hard coal at 4,000 to 6,000 kilocalories, but the mines there, owned by state-owned company TTK, are very difficult fully mechanized longwall mining, due to the tectonical structure of the seams. All the other coal reserves are lignite, except in Soma where there is hard lignite and the quality is in the range of 2,500 to 3,500 kilocalories – still poor compared to international standards. In Elbistan, the coal has typically 1,000 to 1,500 kilocalories per tonne only, and has much sulfur and water content.

VK: Given the quality of coal in Turkey due to the very complicated geological structure in Anatolia, Turkish coal mining companies do have remarkable challenges to mine their resource.

Turkey has introduced the UMREK standard. How high are technical standards in Turkish mining?

UR: DMT experts are certified to do reporting according to Australian JORC Code and Canadian Standard NI 43-101 and our Turkish customers demand international standards, however their budgets are constrained. There are limited Turkish accredited experts, which is why DMT offers its independent mining consulting and engineering services in Turkey. The international regulations are very strict and all our chartered professionals must follow them – DMT's international credibility relies on this. To adapt to local conditions and budgetary constraints, instead of bankable feasibility studies we offer more pre-feasibility or scoping level reports.

VK: Having said that, the state-owned companies, the General Directorate of Mining Affairs and the Ministry of Energy have all said they absolutely want to abide by international standards for resource/reserve evaluation. So, there should be more demand for such services.

What are DMT's key strategic objectives in Turkey in the next one to two years?

UR: In Turkey, junior companies often buy a new mining license before investing in international reporting. We want to support our customers in exploration from day one. This means we will provide standard operating procedures when our clients start drilling, and when the exploration campaign has finished we will support them in sending samples to internationally certified laboratories in Turkey, of which there are few, especially for coal. Then we can build the mine model to estimate the cost per tonne of mined material based on international accepted studies (scoping, pre-feasibility and feasibility studies). Furthermore, we are offering ventilation, gas drainage, rock-mechanical and mining machinery studies for mine planning. Also, our accredited experts are doing HS training and site assessments to reduce risk in mining operations. ■



Mustafa Bayar

General Manager

**BAYAR INDUSTRIAL SERVICES
AND PLANTS MECHANICAL
MANUFACTURING TRADE CO**



The Soma disaster happened because of poor ventilation resulting from bad mine design.

There was one gallery with everything inside it: coal, conveyor, personnel intake and ventilation, all in a 14-m² tunnel.



What are Bayar's activities and services in the mining sector?

We work in the mining and energy sectors mostly. Our mining business is split into two parts: exploration and industrial minerals ore processing and enrichment. We cover the drilling and exploration phase which includes all geophysical exploration. There are many core-drilling companies in Turkey but we make direct bore hole measurements, which only a few companies can do. Bayar also has commercial business activities where we represent different companies in Turkey including UK companies, and are the exclusive agent of China Coal Construction Group (CCCC).

How does Bayar work with the MTA?

In the last two years we have been taking measurements all over Turkey for the MTA which has an extra 1 million-meter target for each year. This is highly significant given that in the preceding 70 to 80 years the MTA only drilled 1.5 million meters. So far, we have carried out 800,000 meters of drilling for the MTA in the last two years all over Turkey.

When we have been making surveys for coal we have made new discoveries, for example for uranium in the Thrace region. Also, there are more than one billion mt of lignite coal in the Konya and Karaman provinces according to our results, and the same amount in Thrace near Bulgaria and Greece. Additionally, we have found 250 million mt of coal in the Eskişehir province.

How successful is Turkey being in increasing its coal production?

Firstly, clean coal technologies should be employed to reduce public opposition to coal projects in local areas. Also, the government does not have thorough planning in place to increase production but rather has a privatization policy for mine rights and private companies to then sell coal to the Electricity Generation Company (EÜAŞ). The government does not want to invest money into the sector but requires private companies to build power plants if they own mine rights. Power plants must be built in the correct place, as for example there is one being built in Çayırhan where Ciner Holding already has a power plant, but there is no coal left.

Bayar is working in Zonguldak for the Turkish Hard Coal Company (TTK). What is the scope of this project?

We are representing CCCC because surface mines and ores are almost completed in Turkey and we must go deeper. For example, all of Cengiz Holding's surface copper mines have been taken underground. We have built galleries, tunnels and inclined drifts, and since 2001 we have completed nine mine shafts with CCCC.

Regarding the Zonguldak project, the tender, which we won with China Coal No. 3 Construction (Group), involved the deepening of the existing shaft from 360 meters to 850 meters with a 6.5-meter diameter, to reach the coal seams deeper underground. Producing 4 billion mt/y, China is the world's biggest coal producer. Our role is to facilitate technology transfer to Turkey. Previously we worked with UK companies, however now coal mining has finished there and so China is the leader. CCCC can move a shaft four meters deeper every day, meaning a shaft of 1,600 meters can be completed in approximately one year.

What is crucial to improve safety standards in underground mines?

The Soma disaster happened because of poor ventilation resulting from bad mine design. There was one gallery with everything inside it: coal, conveyor, personnel intake and ventilation, all in a 14-m² tunnel. In the Zonguldak mine, for example, these are in separate locations. After the disaster, health and safety regulations increased a lot. For example, employing a health and safety manager became compulsory and European standard regulations for coal mines were introduced.

How does Bayar plan to grow its business going forward?

We are also involved in industrial minerals and with the top companies in Turkey. Bayar is one of the leading companies in the energy sector due to its activities in coal but also natural gas – for example we are working with another Chinese company as a sub-contractor on a natural gas project at Lake Tuz. This is a US\$1.2 billion government project, financed by the World Bank. Regarding mining, we are now developing the first lithium investment in Turkey, where we will make some investments with Turkish partners. ■

Mehmet Özten

General Manager

ENMAD SONDAJ AND ENERSON ENGINEERING



Could you introduce the main activities of Enmad Sondaj and Enerson Engineering?

Both companies were set up in 2007. Enerson mostly deals with geophysical exploration; we do gravity, shallow seismic, magnetic, IP resistivity and electro-magnetic surveys, including controlled source audio-magnetotellurics (CSAMT), audio-frequency magnetotellurics (AMT) and transient electro-magnetic surveys (TEM). With Enerson we are also providing wireline borehole logging services to the mineral exploration industry. We work in Turkey, Greece and Balkan countries like Serbia, Kosovo, Macedonia and Bulgaria.

We set up Enmad to produce drilling rigs and do work as a drilling contractor. 2017 and 2018 have been very fruitful and this year we already produced and delivered 32 rigs to Turkish Petroleum International Company (TPIC). In 2017 we produced eight rigs and sold five of them to MNG, who are active in gold mining in Liberia and Burkina Faso, and two to Saudi Arabia. We are nowadays working as a drilling contractor mostly for MTA projects with eight rigs. We are also working as a well-logging company and on coal exploration projects for the MTA.

How has the market been for drilling companies in the last three years?

The private sector and MTA's drilling projects did not amount to enough demand. 2017 and 2018 have been better as MTA asked for 1 million meters of drilling from the private sector in 2017, and this year 2 million. However, the prices are still not high enough. There is no risk sharing between client and contractor. When a contractor faces very difficult drilling conditions, it can easily lose money. All the drilling contractors worked for low prices until now to be able to survive and keep the drilling crews. However, now this has started to damage the sector.

What is next on the horizon for Enmad and Enerson?

We want to work as a drilling contractor in Africa and South America since prices and conditions are more favorable there. For geophysics, we will mostly concentrate on well logging and electromagnetic surveys. In this area, Turkey and the Balkan countries are our main priority. In Turkey, there are too many companies doing IP surveys, so for us it is better to move into more advanced technologies. ■

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Huseyin Tekin

Managing Partner

ENCON LABORATORY



What are the main services of Encon Laboratory?

The scope of our services includes most of the environmental media such as air, water, soil, waste and noise. When Encon first started consulting, it used the monitoring and analysis services of universities for its projects. In time we saw the need and the opportunity for laboratory services and decided to establish our own laboratory in 2006. Then, in 2014 we added acid rock drainage analysis and, in 2017, geochemical analysis to analyze the metal content in ores. We are also accredited for carbon and sulfur measurements.

How does Encon measure acid rock drainage and why is it now providing this service?

Acid mine drainage measurement is new to Turkey. In 2015 a new regulation was introduced by the Ministry of Environment and Urbanization which mandated that the acid producing capacity of mining waste should be defined for a project. The ministry gave companies a two-year grace period to create a mine waste management plan. To measure potential environmental damage from acid mine drainage, first one must take drill samples. Next one needs to do static tests (which replicate nature) and, if there is a problem, kinetic tests, which

take place over six months to a year. We use US and European standards to measure sulfur, carbon and other parameters required for the static tests.

What support does Encon provide in sludge analysis?

We are involved in EU-funded projects for technical assistance and construction supervision of waste treatment plants all over Turkey for municipalities. Our consulting arm also does sludge management and waste water management plans and our laboratory does sludge analysis. Generally, we provide a package of services for a company which encompasses both consulting and laboratory services.

How will Encon Laboratory grow its business in the next few years?

In the next two to three years we plan to mainly compete in the Turkish market. However, according to our research, we see there is opportunity in international projects, mainly in Central Asian Turkic countries, as well as mining projects in North Africa, and EU-funded projects in the Balkans. Our plan is to establish two liaison offices: one in the Balkans (perhaps Romania or Montenegro) and one in Azerbaijan or Kazakhstan. We are still doing some feasibility studies on this. ■



Şahin Özdemir

Chairman of the Board
MITTO CONSULTANCY

The government offers some incentives for companies that combine their reserves by reducing forestry fees by 50%, along with other encouragements. Momentarily this regulation only applies to quarries and coal mines, however it is expected to be extended to other mining commodities.

Could you introduce the main activities of Mitto Consultancy?

We started providing services in Turkey 11 years ago and now have 45 employees. Mitto provides solutions to mining companies from exploration to production and reclamation. Additionally, we carry out environmental impact assessments; our aim is to make mining in Turkey more environmentally sustainable. Mitto has four departments which all work together on a project such as an EIA. For a variety of consultancy projects, we also collaborate with the universities, such as Middle East Technical, Hacettepe and Bilkent universities. We are a Turkish company with Turkish engineers and would like to extend our services to other parts of the world, using our expertise. As well as Turkey, we are also trying to enter Sudan and Kyrgyzstan.

What innovative technologies is Mitto using which enhance its services?

The programs we are using are highly advanced by Turkish standards. We use software such as Surpac, Leapfrog and FreeFlow to create sustainable mining operations, optimize production and design mines. Mitto also works on acid rock drainage and in situ barrel tests, preventing seepage and showing that mining can work without harming the environment. We use a technology from Australia called hydrotalcite which helps prevent seepages. Through this process we separate solids and liquids to reclaim the metals. Unfortunately, this is still a new technology to Turkey. Only Gümüştaş is using it right now but we hope it will become more widespread.

Also, we use virtual reality (VR) technology to introduce mining projects to government officials, so that they can explore a mine from their office.

Turkey has complex geology with small deposits. What is being done to overcome this?

Coal and quarry licenses will be combined and turned into the mining fields. The license owners will have shares from the single company that will be set up and the shares will be determined according to the mineral reserve quantities license owners have. With this solution, reserves will be used more efficiently and new investments will be more feasible. Alongside this, metallic mines open to bids will be transformed into mining fields. Therefore, the opening of mineral processing plants which are used to create final products will be incentivized, and previously uneconomic small-scale mines will add more to the economy.

The government offers some incentives for companies that combine their reserves by reducing forestry fees by 50%, along with other encouragements. Momentarily this regulation only applies to quarries and coal mines, however it is expected to be extended to other mining commodities.

Does Mitto work with clients on social impact assessments and what is most important in gaining public approval for a mining project?

We offer social impact assessments to our clients and provide this service if they require funding from organizations such as the EBRD and the IFC. However, they are not often included in EIAs, as environmental impacts are given more importance by the authorities. It costs only 150 TL to sue a company on environmental grounds, and judges often do not have enough knowledge about mining so they stop projects due to public pressure. Therefore, environmental issues are given much importance by the companies.

Often, the local population would like to gain employment from a project, and support for their farming activities. Sometimes the mining company or the government will build a school which will help convince the locals to support a project. Also important are considerations of health risks and water issues.

How does Mitto plan to grow in the future and differentiate itself from other consultancies?

We do not see ourselves as competitors and we seek to share our knowledge with the mining community. Mitto started as a family business but we are aiming to become an international company. We already use international standards and guidelines. Turkey now has the UMREK standard and Mitto aims to have qualified persons (QPs) or provide education for those that want to become QPs. Mitto wants to keep and increase its clients worldwide and give them the best solutions available. ■

The MTA boost to drillers

Still not enough to lift the spirits of contractors due to low drilling prices

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The last three to four years have not been kind to Turkey's drilling industry. Previously, miners from Canada and Australia had flocked to Turkey as a promising frontier mining jurisdiction. As Gökhan Nasuh, general manager, Kayen Sondaj, which supplies drilling equipment and additives remarked: "In the last four years, there was a recession in the market due to metal prices and the approach of the Turkish government to permitting (e.g. forestry) as only companies that already had permissions could go ahead with their exploration projects."

It is in this context that the MTA has helped lift the fortunes of Turkey's drilling industry. Having completed only 1.5 million meters of drilling in the last 70 to 80 years, it has made 1 million meters' worth of drilling in 2017, and is expected to complete 1.6 million meters of drilling in 2018. The are other forces playing their part in lifting the industry, although the MTA is the most significant factor. "This year there is a boom because of the MTA's program and metal prices are going up again. On top of MTA's target, the private sector is doing around 1 million meters of drilling, so the total amount of drilling is approximately 3 million meters this year, which is significant," continued Nasuh. "Turkish Petroleum International Company (TPIC) also has a 1 million-meter program this year and they have bought around 150 diamond rigs from local companies, as well as tooling, some of which we supplied."

Still, all is not so rosy for drilling companies. The MTA does not carry out drilling activities itself but tenders them to third parties. "The prices were very bad so none of us were very happy. The expansion of the Çöpler gold mine and MTA's works did not amount to enough demand. 2017 and 2018 have been better, however the prices are still not high enough," commented Mehmet Özten, general manager, Enmad Sondaj, which has produced 32 rigs in just six months, including for TPIC and the Turkish conglomerate MNG who have gold mines in Liberia and Burkina Faso.

Whilst the MTA has driven demand for companies such as Bayar, which has carried out 800,000 meters of drilling for the government entity over the last two years, some companies have decided not to bid for MTA projects due to the low unit prices, including one of Turkey's most prominent drilling companies, Ortadoğu Sondaj.

Furthermore, much of the MTA's focus is on defining reserves for coal, reflecting the government's strategic priorities, which carries its own complications. "Drilling for coal is important but the depths required are around 1,000m so it is very challenging," remarked Özten. "If you do not have the good luck to have good geological formations, many casings are lost and it is not very profitable. Drilling for minerals is more profitable than lignite."

Unfortunately, with many gold miners, previously the main driver of drilling, leaving Turkey, drilling contractors are not quite out of the woods yet. As Nasuh conceded: "If they come back, demand will rise, but otherwise there will not be as much demand as before in the next two or three years."

As Turkey's mining industry matures and demands for international standards to rise, the requirement to collect better data in drilling activities is rising concurrent with technological advances in this field. Also, if

Turkish companies need to receive foreign financing, this is a necessity. The introduction of the UMREK system, Turkey's answer to the JORC or NI 43-101 standard, has also formalized the need for more data. Nevertheless, Turkey still lags behind international standards of data collection.

Turkey's tough geology, characterized by abrasive volcanic formations, is very difficult to drill, meaning unstable drilling holes are common. Also, as deposits tend to be deeper underground and surface mining is largely finished in Turkey, drilling must go very deep. The MTA, for example, predominantly scans for minerals below 600 meters. This has driven demand for high-quality but, if possible, low-cost solutions. "If a drilling contractor needs to go deep with low-cost, they do not want to pull the drill stream out of the hole, which itself can sometimes take one shift (approximately 16 hours), including changing the bit. Therefore, everyone wants long-life bits, as it saves much time and cost such as diesel and labor," explained Nasuh.

Demand for drilling additives is also strong in Turkey, given that they help keep holes stable.

With unsatisfactory, albeit improving prospects at home, it is common for contractors to look for opportunities elsewhere. Both Ortadoğu and Enmad are working in Pakistan and are eyeing opportunities in Africa, where the Turkish government has developed good relations with various African governments and the MTA is working on projects.

The MTA is rightly lauded for its ambition. However, if fortunes are to significantly improve for the drilling industry, as with the mining sector more broadly, the permitting process will have to change. Demand is unlikely to be satisfactory until these companies feel confident in Turkey's mining regime once again. ■



Cengiz Erdem

General Manager

**GENERAL DIRECTORATE OF
MINERAL RESEARCH AND
EXPLORATION (MTA)**



It is predicted that the demand for energy and mining in our country will increase in the next five years.

We aim to continue exploring our domestic resources, and providing added value to the economy by conducting exploration activities abroad as well.



The MTA has a target of 2 million meters of drilling for 2018, having achieved 1 million meters in 2017. How many meters has it achieved so far in 2018?

The MTA has an 83-year history of continuous improvement by, so to speak, carving its name on the mountains and rocks of the country – every segment of society has traces of MTA's activities. We aim to develop infrastructure and produce data by using science and technology and acquiring, developing and implementing new systems and methods. In 2017, we did about 1 million meters of drilling studies for metallic mines, industrial raw materials, and energy raw materials. At the beginning of 2018, MTA planned to conduct 2 million meters of drilling – we have already completed 1.3 million meters and we plan to reach 1.6 million meters by the end of the year. The MTA aims to set a record in annual drilling in Turkey when these studies are completed.

How important is coal exploration for the MTA?

The MTA carries out exploration activities in energy raw materials such as metallic mines, industrial raw materials, coal and geothermal on behalf of the government to meet the increasing needs of our industrializing country. In line with the 2017 National Energy and Mining Policy of the Ministry of Energy and Natural Resources, strategies based upon the security of energy supply were adopted, and domestic and renewable energy resources were set out as a priority.

The MTA has conducted studies on the determination of which minerals are a primary need of the industry, and coal mining has been designated a strategic priority. For this reason, we allocate between 30% and 35% of our annual drilling target to coal exploration. Because of our studies, new coal mines were discovered and the total coal reserve in our country increased. The exploration and discovery of new metallic and industrial raw material deposits are also of great importance to our institution. In 2018, precious metals such as gold and silver, metallic mines such as iron and copper and industrial mines such as feldspar, huntite and thenardite were discovered and assigned to the General Directorate of Mining Affairs (MIGEM).

Overall, 40% to 45% of the drilling studies targeted for 2018 is allocated to metallic mines, 10% to 15% to exploration of industrial raw materials, 30% to 35% to coal, 5% to rare earth minerals, 8% to radioactive mines and 2% to geothermal resources.

Most drilling in Turkey must be done below 600 meters. What technical challenges does this raise?

Given Turkey's mining history, most mineral deposits with outcrops have been discovered. Therefore, MTA will focus on the exploration of deep mineral deposits with undetailed surface data. With our institution realizing also geothermal drilling studies, drilling depth capacity of geothermal is 3,500 meters, and for metallic mines it is 2,200 meters. Although we sometimes face difficulties during drilling due to field conditions or technical problems, we overcome them thanks to our professional staff and the services we procure. The private sector has also increased its drilling depth capacity. The average total depth of drilling studies is about 400 meters. We aim to increase this to 700 meters at first, and then to 1,000 meters with our new studies.

What are some of the MTA's core goals for the next five years?

It is predicted that the demand for energy and mining in our country will increase in the next five years. We aim to continue exploring our domestic resources, and providing added value to the economy by conducting exploration activities abroad as well, to reduce our foreign source dependency in energy and mining. Indeed, revealing new metallic, industrial and energy raw material deposits both in the country and abroad is among our primary objectives.

Today, the main factors for the sustainable development of countries are energy resources and high technology systems. However, if the abundance of energy resources does not feed and support high technology systems, their development cannot be realized. For this reason, the MTA has been creating new projects for the next five-year period with the aim of exploring economical prosperities, especially raw materials that can support the development of high technologies. ■





Technology and Services

"In places like Australia, Canada, the United States or South America, they can build bigger capacity plants. In Turkey processing plants have smaller capacity. So, the operating cost per tonne plays a more important role. Companies must invest in new technologies to survive."

- Murat Us,
Middle East and Turkey Sales Coordinator,
FLSmidth



Adding Value to Turkey

Technology providers take the industry to the next level

As Turkey moves along the path of development, every segment of its economy is striving to move up the value chain for the good of the country's competitiveness. Turkey is working towards meeting the highly ambitious goals set out by the government's Vision 2023, marking the centenary of the founding of the Turkish Republic. The government is aiming for US\$15 billion in mineral exports by 2023, a significant element of the wider goal of reaching US\$500 billion in exports by 2023. This is important not only for the general economic development of the country but also to reduce Turkey's current account deficit, a persistent structural economic weakness.

The recognition that Turkey's miners must add more value to what they produce also reflects a natural progression of Turkey's mining industry as it matures from a frontier to a more established jurisdiction. As Arif Çankaya, sales and marketing manager at Gursan, which manufactures mineral processing machinery, remarked: "Ten years ago, Turkey was only doing easy processing and produced pre-processed materials to be sent to other countries. Now, companies understand that this is a non-profitable way to do business, and they are investing heavily in processing equipment to finish the whole process in one line."

Mineral processing is especially important in Turkey due to its unique geology,

brought about by it being at the meeting point of four tectonic plates – the Anatolian, African, Arabian, and Eurasian. "The South American geological system is comparable," remarked T. Kemal Türeli, mineralogist and petrographer at Argetest Mineral Processing, R&D and Analysis Services. "Turkey has many different metal mineralizations but, because of the geological structures, the deposits are smaller. Therefore, it can be problematic to recover minerals economically... This is especially the case as easy mining methods have finished in Turkey and now more complex deep drilling and underground mining is becoming more prominent."

Indeed, whilst Turkey has much to offer, from gold and base metals to coal, there are, as yet, no world-class mega deposits, and perhaps never will be due to the nature of Turkey's geology, which is why more value must be sought through mineral processing.

A market to keep an eye on

All this means a growing trade for mineral processing service providers and opportunities for investors in this sector. Gursan, for example, has found success as a local provider of all types of crushers and screeners, such as jaw crushers, impact crushers, cone crushers and side crushers. Overall,

there are around 200 providers of crushers and screeners in Turkey, of widely varying quality. Among higher quality providers are international technology players such as Weir Minerals, Sandvik, FLSmidth and Metso, that also provide grinding mills, flotation cells, magnet separators, dewatering equipment and complete mineral processing plants.

There are no large greenfield projects currently ongoing that would require mineral processing solutions. Intriguingly, however, companies in this segment of the market are reporting robust sales volumes. According to Tuncay Özeren, regional sales manager, Weir Minerals, the company made a good start in Q1 2018, beating its forecasts by 25%. "We have never missed our targets in Turkey and grow consistently by 30-40%," he said.

Weir and Metso also expect increased demand in 2019. "From the beginning of the year until now, the opportunities have mostly been in brownfield projects with greenfield ones coming at the end of Q4 2018 or due in Q1 2019," said Mert Katkay, sales manager, Metso. "We are now mostly dealing with optimization projects and spot sales, to help producers increase capacity or improve recovery, as well as two big projects in the development stage."

Concurrent with the mining industry's own goal of adding more value to miner-

als mined in Turkey, the mineral processing machinery industry is becoming more localized. “Turkey is like the China of Europe – it is possible to manufacture everything and with better quality,” claimed Özeren.

70% of Weir’s cyclone clusters are produced in Turkey, as are parts like back plates, motors and motor supports for their pumps for which final assembly takes part in Turkey. Metso manufactures flotation cells, grinding mills, shells, magnet separators and other big items in Turkey. Gursan, on the other hand, manufactures all its crushers and screeners in Turkey, which are tailor-made to a client’s specific needs.

Turkey still has some way to go to move higher up the manufacturing value-chain, though. “It depends on the technical needs; if it is not too complex, it is very easy to do local manufacturing in Turkey,” remarked Erdem Tüzünalp, regional general manager, Turkey & MENA, Epiroc, who assures that the company faces no local competition for

its premium products like tunneling machines, blasting machines and underground transport.

New technologies like internet of things (IoT), next-generation networks, automation and robotics, virtual simulation and artificial intelligence are revolutionizing the mineral processing industry worldwide, and Turkey, with its tougher geology, stands to gain from these trends. Advanced process control (APC) systems, for example, are generating interest for their ability to improve recovery rates and efficiency. “Our APC technology is mine to mill, as we can observe the mineralogy of the ore in each drill and, with instant chemical analysis through online stream analyzers, customers can change the parameters of flotation cells even before processing,” explained Katkay. Such value enhancing technologies will be critical in Turkey given its smaller deposits. Murat Us, Middle East and Turkey sales coordinator at FLSmidth remarked: “In countries like Australia, Canada, the United

States or in South America, they can build bigger capacity plants. In Turkey processing plants have smaller capacity. So, the operating cost per tonne plays a more important role. Companies must invest in new technologies to survive.”

As well as equipment providers, there is a burgeoning need for mineral processing consulting, sampling and engineering support. Argetest nicely fits into this niche and has seen growing demand for its services. “In Turkey there are no other companies doing all the things we do (testing and analysis, mineral processing laboratory services and consulting). Other companies only focus on one of these,” commented Burak Köse, R&D manager, Argetest.

Pinpointing opportunity in Turkey’s mineral processing needs

Most mineral processing service providers are targeting working with the gold indus-

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PROSES

PROVIDING SOLUTION FOR THE MINING INDUSTRY



ENGINEERING AND CONSULTING SERVICES ESPECIALLY IN NON-FERROUS METAL AND PRECIOUS METAL PRODUCTION SECTOR

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- Assessment and development of the mineral resources
- Assessment and development of metallurgical processes
- Selection of technologies
- Feasibility studies
- Outsourcing and supply processing equipment
- Outsourcing and supply chemicals and raw materials
- Outsourcing and supply of iron, lead, aluminum, steel, and alloyed steel products
- Outsourcing and supply of spare parts
- Supply of piping material, valves, and fittings for all processes
- Recycling technologies
- Waste management and waste treatment

Arif Çankaya, Ümit Nazligüloğlu & Ahmed Ayyash

AÇ: Sales & Marketing Manager

ÜN: Sales Engineer

AA: Sales Engineer

**GURSAN CRUSHING &
SCREENING**



AÇ

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AC: The challenge is that Turkish companies usually export to North African countries and compete on price. There are about 200 producers in Turkey but they lose money based on this approach, rather than focusing on good design.

What are the growth prospects for mineral processing technologies at present?

AC: Every year demand grows. Ten years ago, Turkey was only doing easy processing and produced pre-processed materials to be sent to other countries. Now companies understand that this is a non-profitable way to do business, and they are investing heavily in processing equipment to finish the whole process in one line.

How does Gursan differentiate itself and could you tell us about its history in the Turkish market and further afield?

AC: We produce niche, not easy to make machines. We are the only company in Turkey that produces all types of crushers and screeners, such as jaw crushers, impact crushers, cone crushers and side crushers. Additionally, we produce vibrating screens, conveyor belts, wet/dry process machines etc. Also, unlike other companies in Turkey, we do our own design and do everything in house. Other companies prefer to use consultants for mineral processing design but at Gursan we cover the whole process when a client comes to us. We do a tailor-made design, partnering with other companies where we need to and we manufacture the machines.

Our engineering group has 20 years of experience and all have field experience, whilst our sales team is often on a client's site and channel feedback to our design team. In total, we have been in the Turkish market for 40 years and have grown with it. From 1990 to 1999 we only served the domestic market but now we export to 35 countries; our sales are 50% to Turkey and 50% abroad.

What types of mineral producers does Gursan typically work with?

AC: Generally, we focus on mining rather than aggregates. We work with mineral producers of gold, nickel, cobalt, iron ore, and generally tough minerals which require a lot of work and where we must always be available to the client.

What is the reputation in international markets for mineral processing equipment made in Turkey?

AC: The challenge is that Turkish companies usually export to North African countries and compete on price. There are about 200 producers in Turkey but they lose money based on this approach, rather than focusing on good design. We are one of the few companies with a focus on quality. For good design, quality machines and consultancy services, spare parts and after sales services, you cannot have cheap prices.

AA: To take Bulgaria as an example, a few years ago we had no machines there but after entering the market we now have five complete plants and are manufacturing a complete wet screen system. As with most of our projects, it is a turnkey process and all the machines will be produced in Turkey. The customer came to us because they needed products which meet their specific needs.

Gursan has a strong focus on R&D. Can you provide an example of an innovative solution it has brought to the market?

ÜN: There are many, and our cone crusher is a particularly good example. It contains hydraulic systems and electrical information and we have been continuously refining this product. Cone crushers were previously only available through imports by international players but since 2007/2009 Gursan began to produce them. We are the first Turkish company to do so, and according to our own design.

How is Gursan taking advantage of trends like automation and Internet of Things?

AC: We have a project called 'Smart Crushers'. Crushing is a dangerous job and the material that our machines handle is tough and abrasive, especially basalt, granite and gabbro. Often operators must do maintenance on the machines which is not easy. We have a new surveillance system using the latest software and hardware which will calculate the weight of material which enters and exits the machines and will analyze and report any faults with any of the machines in a plant. For example, it could tell the operator that the wheel parts are wearing so he can adjust them, or recommend spare part changes. ■



Faik Sener

General Manager

**PROSES ENGINEERING,
CONSULTING,
CONSTRUCTION AND DESIGN**

The government's intention is to have big companies investing in mining, as small companies with no funds have licenses but do not operate and lay idle, which does not benefit the economy.

Could you provide us some background about Proses Mühendislik?

Proses was established in 1997 in order to provide engineering services for base and precious metals, especially lead, zinc, copper, gold and silver. In 2007 we started working on a gold project in Azerbaijan. The project was developed initially as heap leaching but evolved with the addition of tank leach and copper flotation to the system. It is now a big project and Proses contributed greatly in terms of supply of materials, consumables, engineering and construction.

At the same time, we started growing and took on projects in Saudi Arabia. The client's mine and plant there had been suspended and we restarted it with revamping and repairs while at the same time we built a SART plant. Recently we also signed a contract with another Saudi company for the processing of a gold mine and construction of a plant on a build-operate-transfer (BOT) basis. Proses will continue with operations for a while after construction.

Can you tell us about the commercial and technical agreement Proses has with Alexander Mining plc?

Up to 2010, our main business line has been zinc, due to our working on a zinc smelter in Kayseri and other contracts. We have been very much interested in treating low grade oxide zinc ore. Until recently, zinc oxide ores with at least 20% zinc grade could be used but nothing below that was economical; our ambition has been to treat such lower grade zinc oxide ores, including below 10%. At today's zinc prices, it is even possible to treat 5% zinc ores but we need to have the right technology to do this.

In our research we came across Alexander Mining's patented AmmLeach technology which could transform the feasibility of processing lower grade ores. We plan to build a 100,000 to 300,000 mt/y ore processing plant in Turkey focusing on zinc or copper using their technology, and then market the technology under a commercial partnership. We are talking to mining license holders in Kayseri to assess the potential and a suitable location. After this, we will do an environmental impact assessment. We will work with smaller producers and those past producers that have stopped their operations that we hope to get starting again.

There were concerns that feasibility studies in Turkey were not up to international standards. Now that Turkey has the UMREC system, have things changed?

Many mining companies have been reluctant to invest in feasibility studies because they require a lot of investment but now the mentality is changing, and companies are moving towards bankable feasibility studies. Proses wants to be involved mostly in the engineering and operations side, as well as construction. Although, we can do feasibility studies.

Other than its processing capabilities, what other services does Proses provide?

Proses also has trading activities. We provide grinding balls for the mining industry and are the representative of a Ukrainian company in Turkey, Azerbaijan and Saudi Arabia. We also provide spare parts for pumps, chemicals, consumables and related products for construction and operations.

Proses is Middle East focused – what trends are you seeing for your services in this region?

Companies in the Middle East have a need for our services to improve their recoveries, operations and productivity rates. We recently spoke to a major Saudi mining company that needs a SART plant, which uses a process to recover copper and cyanide from cyanide leach solutions and provides an extra income unit of copper sales. This process also reduces production costs – a huge advantage, especially as even with high copper in a solution, gold leaching operations may be stopped. On top of this and the contract for the gold processing plant we have signed, we have had much interest from gold and base metals producers in different countries.

What is your outlook for Turkey's mining sector?

The government's intention is to have big companies investing in mining, as small companies with no funds have licenses but do not operate and lay idle which does not benefit the economy. Therefore, it can be hard to obtain licenses and the government is providing huge incentives for large scale mining. ■

Tunc Gucuyener

General Manager

ALFRED H. KNIGHT (TURKEY)



What are AHK's focus areas in Turkey?

Alfred. H Knight (AHK) was established in 1881 and has been at the forefront of the metals, minerals and solid fuel industries for over 135 years. AHK Turkey was established in 1987 with a core focus on the mining sector and manages key locations in the Balkans, Albania and Pakistan. In 2014, the business relocated its laboratory to Mersin and gained ISO/IEC 17025 accreditation in 2018.

How does AHK work with the coal industry?

The Turkish government is prioritizing coal usage, advances in electric power and nuclear energy. Turkey now imports 30 million mt of coal a year and this is expected to grow in the next five years. AHK Turkey has invested in laboratories and in the near future we plan to obtain ISO 17025 international accreditation for coal analysis. AHK also provides services in biomass and we have ambitions to operate here once Turkey has become a recognised player in the biomass industry.

Large investments are being made into chrome production, and rare earths are

gaining attention. Are you involved in these markets?

We expect chrome production to grow beyond 1.35 million mt in 2018. As a leading provider of services in the Turkish chrome market, AHK Turkey manages all testing and analysis in-house, with responsibility for Turkey, Albania and Pakistan. Taking samples from chrome is not straightforward and it requires knowledge and expertise. Our employees specialize in chrome sampling and analysis which makes us well equipped to support our clients' needs. As for rare earths, this is a very niche market and AHK Turkey has not taken on many projects in this area yet.

What is the availability of skilled labor in chrome analysis?

Universities do not teach students how to inspect and sample chrome, therefore the availability of skilled workers is tight. When we take on engineers we need them to be competent to high AHK standards and therefore we place the emphasis on training and gaining on-the-job-experience. ■

Nezih Dogu

Country Manager

BUREAU VERITAS



Bureau Veritas has the largest fire assay capacity in Turkey. Could you tell us more about this?

We are a proven fire assay laboratory for gold and silver. We take part in round robins and we perform perfectly both for low grade and high grade gold. We also provide a very fast turnaround. As the exploration industry has not been doing so well in the past years, rather than diversifying packages, we fully focused on gold, silver and base metals. Now the industry is picking up again.

As ore grades fall, there is more need for beneficiation. Are you seeing more demand in this area?

Of course. From our side, historically, producers in Turkey have used their own in-house laboratories to control production. There are very little exceptions but like in many parts of the world, we believe this is going to change in Turkey soon. We have a division specifically for the onsite business and we have been working with them on opportunities in our region.

Foreign investment in mining has dropped in recent years. Is it growing again?

The commodity markets have been performing badly in the last few years which has

dampened foreign investment in exploration but now this is recovering. The incentives are already in place. Meanwhile, our industry does not necessarily depend on foreign investment. There are serious local players in the field with considerably important projects.

How does Bureau Veritas differentiate itself from other players in the market?

Bureau Veritas has combined its existing laboratory expertise with new acquisitions. We have combined all the know-how to produce a very efficient technology through R&D in our Perth and Vancouver centers. Australia is well-known for its X-ray fluorescence (XRF) practices, and North America for its inductively coupled plasma mass spectrometry (ICP-MS) practices. We have generated a new package for client samples in Western Australia combining high productivity robotic fusion technology with state of the art laser ablation and ICP-MS. This package provides a fully extracted quantitative analysis for all elements. The method can also be coupled with wavelength dispersive XRF to provide a complete quantitative total whole rock analysis. This technique offers safety along with environmental advantages, since we do not use any acids in digestion. It is fast and repeatable. ■

Emin Ulu, Abdullah Buhur, Kemal Türelî & Burak Köse

EU: Company Manager

AB: Laboratory Manager

KT: Mineralogist and Petrographer

BK: Mineral Processing, R&D Manager

**ARGETEST MINERAL
PROCESSING, R&D AND
ANALYSIS SERVICES**



EU



AB

Can you explain the relationship between Turkey's geology and its ore deposits and what is the current condition of mineral exploration in Turkey?

KT: Turkey is located on the Alpine-Himalayan belt, a quite active tectonic zone. The location of the country resulted in the formation of many different medium and small sized ore deposits that usually have complex structures.

Outcrop mining, which has been carried out in Anatolia since antique ages, is coming to an end. Mining methods based on systematic scientific research and 3D modeling, which require many drillholes and low detection limit analyses, are taking the place of outcrop mining. Therefore, quick analyses that ensure international norms are followed, laboratory and pilot scale beneficiation tests and cost analyses depending on those tests, are gaining a lot of importance.

Who has typically carried out mining activities in Turkey?

EU: Small and local scale mining activities, carried out for thousands of years in Anatolia, began to be managed and executed by governmental institutions after the establishment of the Turkish Republic in 1923. Starting from that time, mineral exploration activities have been carried out by MTA, whereas mineral processing activities have been done by Etibank.

In more recent years, important economic and political developments also influenced Turkey's mining sector. This resulted in increasing interest from the Turkish private sector, as well as international companies, in potentially promising mining activities in the country. Turkey's mining sector has established the necessary mining infrastructure, like human and technological resources, so it is ready to cooperate with the global system.

In the context of easy mining methods coming to an end in both Turkey and other countries, how does Argetest meet the needs of its clients?

AB: Argetest was established in 2012 to meet the demands of the Turkish mining sector. It was founded by experienced staff who have worked both in governmental institutes and private companies for years. Our laboratory closely follows technological developments and international studies without compromising on its main principle of high quality work in chemical analy-

sis, mineral processing and research and development fields.

Argetest currently has EN ISO IEC 17025, ISO 9001, ISO 14001 and OHSAS 18001 quality certificates. Our company conducts analyses and beneficiation studies delivering results accepted by international standards like JORC, NI 43-101, CRISCO and is recognized by QPs, as well as stock markets. Our laboratory performs soil, rock, core and concentrate sample analyses. In our mineralogy and petrography department, thin and polished section studies are conducted including process mineralogy. In our mineral processing and R&D unit, flotation, jig, shaking table, magnetic separation (dry-wet) and hydrometallurgical studies are carried out. Mineral processing studies are executed in order to obtain effective plant flow sheet design. We also perform plant process revisions and reactive comparison tests.

What minerals is Argetest targeting in its business development strategy?

BK: Due to its geological structure, Turkey has significant potential in gold, silver, copper, lead, zinc, chromium and iron, as well as various industrial minerals. Argetest is accredited for analyses of parameters mentioned above.

Our target is to keep the current quality level in our analyses which is subject to international audits and improve it even further considering the developments in the field. In the medium and long terms, we believe demand for analyses and metallurgical tests of platinum group minerals, rare earth elements and nickel bearing formations will increase. Our laboratory has started studies in this context and is already accredited in Pt-Ni-La-Ce-Th-Nd-Pr elements. We will continue to expand the content of our accreditations in the coming years. We believe our increasing experience will result in greater success in solving more complicated mineral processing and efficiency loss problems.

What are Argetest's priorities for the future? Is the company looking at business internationally?

EU: We are establishing two branches in Turkey, and the next step is to go abroad. Currently, reflecting its high rate of development and growth, Argetest is receiving samples from all over the world. Argetest wants to establish another branch in a neighboring country in the next five years. ■

Image courtesy of Tüprağ Metal Madencilik

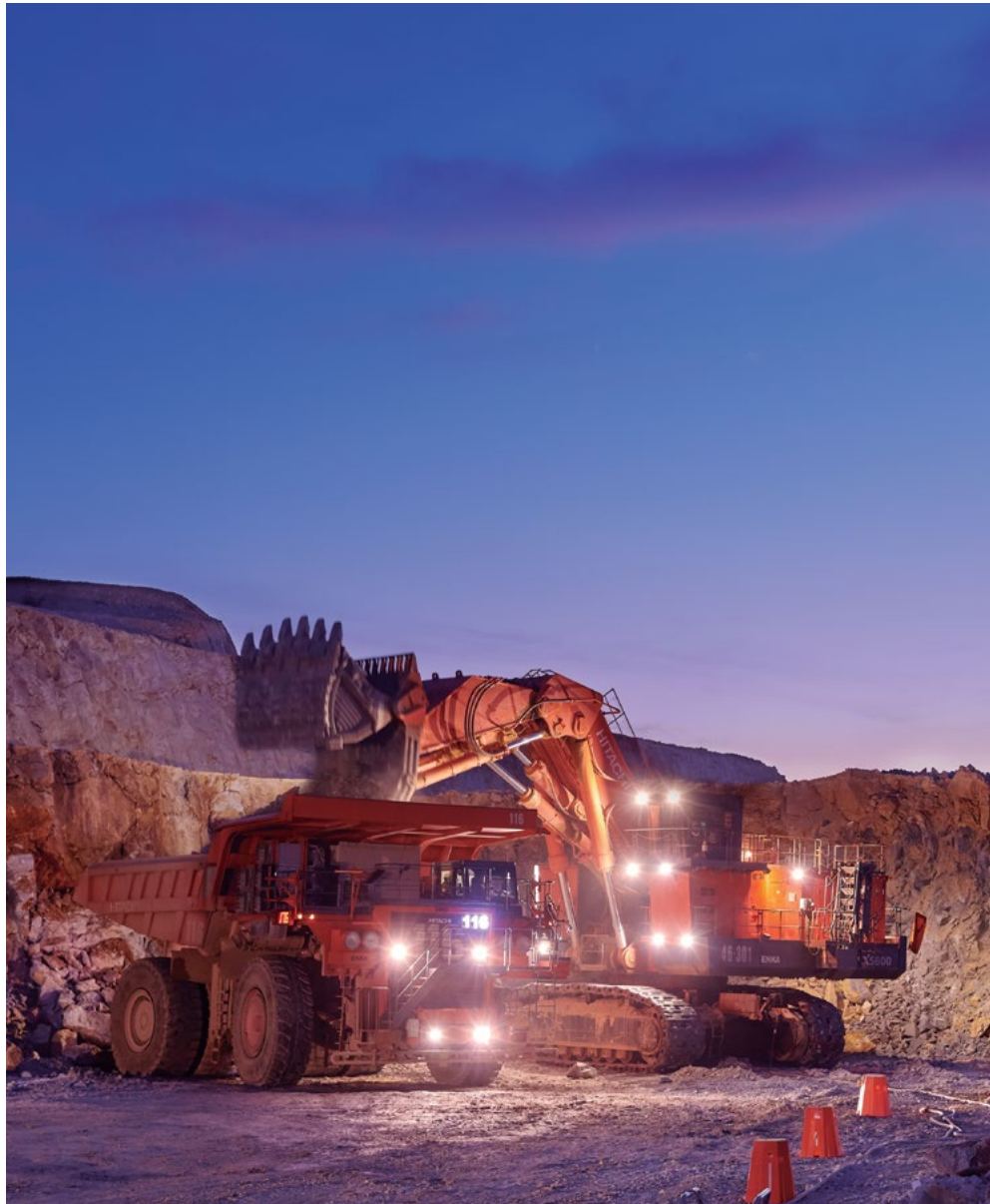
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try as it remains Turkey's most prominent mineral and gold producers are usually able to afford a higher price point compared to other mineral producers. However, there are also many opportunities to be found elsewhere. "We are targeting gold, copper and base metals, and secondarily chromium and iron. In some parts of Turkey, we are also working on platinum groups," remarked Köse.

Indeed, one of the biggest projects announced recently is Acacia Mining's copper project in Hanönü, Kastamonu, which began production in 2018. The deposit represents the largest copper reserve found in the history of the Turkish Republic, which is expected to meet 10% of the country's copper demand, thereby driving mineral processing demand for copper.

According to Tolga Tunc, general manager of trading company First Mining Madencilik and one of the largest exporters of iron ore from Turkey, copper presents a huge opportunity: "There are not enough beneficiation facilities as it takes huge investments. We would like to provide more such facilities, specifically in the Giresun area. We have sent a letter to the Ministry of Energy to explain what we would like to do in Turkey in this regard, but for this we need government support. Ten years ago, it was easy to obtain a license but now it is a big deal to obtain one, and then one must wait another year to get permissions."

Meyra, part of the Delta Group, has a proven deposit of 4 million mt of lead and zinc and has started to produce run-of-mine (ROM) sulfide lead and zinc ore which is sold to nearby flotation plants. "We are now awaiting permission for a flotation plant and have prepared a US\$6-7 million capex, with a US\$4 million investment into the plant itself," commented Sumeyra Esgun, founding partner and general manager, Meyra. "We hope the plant permissions will be completed by the end of 2018."



Furthermore, due to higher commodity prices, some minerals are now worth processing even at much lower grades. "Until recently, zinc oxide ores with at least 20% zinc grade could be used but nothing below that was economical; our ambition has been to treat such lower grade zinc oxide ores, including below 10%. At today's zinc prices, it is even possible to treat 5% zinc ores, but we need to have the right technology to do this," explained Faik Sener, general manager, Proses Engineering, Consulting, Construction and Design, which plans to build a 100,000 to 300,000 mt/y ore processing plant in Turkey focusing on zinc or copper using new processing technology.

These trends create an opportunity for mineral processing experts to present innovative solutions to open this segment of the market and add further value to Turkey's mining industry.

Overall, demand for mineral processing looks set to remain strong across a wide array of minerals in Turkey. Of course, as with the industry more broadly, service providers and producers alike will be hoping permitting and licensing challenges are eased so that mineral processing plants can be easily built. That way, Turkey's mining industry can play its part in helping Turkey reach its ambitious economic development goals. ■



Erdem Tüzüenalp

Regional General Manager,
Turkey & MENA
EPIROC



Typically, the use of automation services limits the number of people underground as operations can be managed remotely. This will have a big impact on the number of accidents. The market is moving this way, and we can now control a machine from anywhere remotely.

Epiroc split from Atlas Copco in 2017. Could you introduce the role of the Turkey office and your main service offering?

Atlas Copco has one of the longest histories of any international company in Turkey, having been in the country since the 1950s. We used to have a manufacturing plant in Tuzla before the customs agreement with the European Union but now there is no manufacturing and we focus on services. As of April 2018, from Istanbul we cover eighteen countries: Turkey, Georgia, Azerbaijan, Iran, United Arab Emirates, Saudi Arabia, Qatar, Kuwait, Oman, Bahrain, Egypt, Afghanistan, Iraq, Syria, Pakistan, Lebanon, Jordan and Yemen. We have another hub office in Dubai and some employees in Saudi Arabia and Oman. As Epiroc, we have very high growth targets organically and inorganically.

There are many mining equipment providers in Turkey. What is Epiroc's competitive edge?

We have had a separate entity in Turkey for a long time, whereas most of the other international players rely on country distributors. Atlas Copco has always worked to build its own customer centers worldwide. There are of course smaller local manufacturers, and competition is changing depending on the application. For some applications the competition is wide but for others it is still very limited. For products like tunneling machines, blasting machines or underground transport, our premium products, there are not local players so we face only competition from bigger international manufacturers for these.

In what mining equipment manufacturing applications is Turkey particularly strong?

It depends on the technical needs; if it is not too complex, it is very easy to do local manufacturing in Turkey. Companies here are good at water well drilling, dimension stone applications and hydraulic breakers. Therefore, Epiroc focuses on premium markets and we are planning to do some local acquisitions.

There are big investments happening in base metals in Turkey. Which markets are you targeting in particular?

Turkey is still relatively new to mining but there are a lot of reserves, and after the privatization drive the industry grew rapidly. However, we still do not have a high enough level of exploration and there are social and environmental problems, which means it is difficult to get permits. We know there are a lot of gold reserves, with some still waiting for permits. Additionally, we are waiting to see what happens with the licenses held by Koza Gold, the biggest gold producer, after they have been taken over by the government. Nevertheless, the gold sector is an area we are targeting, as their level of investment matches with our premium products. Moreover, we are targeting all minerals, except coal. We work with the big producers in Turkey. We also sell drill rig consumables to drilling companies, but most exploration contractors also manufacture drill rigs in Turkey.

Atlas Copco acquired a 34% stake in Mobilaris in 2017 and has invested heavily in automation. Is the market ready for this in Turkey and how can it help with safety?

Some of the big producers in Turkey are now looking at automation, for example Koza Gold has asked for machines to have more automation features. Generally, however, the market is not at that level in Turkey. It will come but it will take time for mining companies to use more automation services. This is partly due to there not being so many international mining companies in Turkey. Our rigs now have digital features so that we can monitor them worldwide and we are hiring data engineers to help provide more services to customers. We have pilot data hubs and we are investing in this area in Turkey. Typically, the use of automation services limits the number of people underground as operations can be managed remotely. This will have a big impact on the number of accidents. The market is moving this way, and we can now control a machine from anywhere remotely. ■



Murat Us

Middle East and Turkey Sales Coordinator
FLSMIDTH

Could you introduce FLSmidth in Turkey in terms of its history and focus areas?

The Turkish entity was established in 2012 and since then we have opened one office in Istanbul and one in Ankara. The Istanbul office mainly focuses on the cement industry, whilst the Ankara office was set up a year and a half ago to serve the minerals industry. FLSmidth Turkey has approximately 35 employees, with eight in Ankara.

How does Turkey's geology affect the services FLSmidth provides?

Turkey is different to other mining jurisdictions in that you can find all types of minerals here, but the mineral deposits are generally smaller. Therefore, in places like Australia, Canada, the United States or South America, they can build bigger capacity plants. In Turkey processing plants have smaller capacity. So, the operating cost per tonne plays a more important role in Turkey, meaning companies must invest in new technologies to survive.

In the whole of South America, FLSmidth has 20 clients, which they sustain with per-

haps ten sales engineers. Just in Turkey, we have 200 clients, which is more sustainable but reflects the smaller deposits.

Is FLSmidth targeting the premium, high-value side of the market?

We are targeting efficient mining solutions. We are focusing on future technologies, for example one of our projects includes a high pressure grinding roll (HPGR). This is a new technology for mining and will bring significant savings, higher recoveries and energy efficiency. Grinding is the most energy intensive part of a plant. HPGRs can bring 25% to 30% more energy efficiency for grinding circuits, so this has a big impact both on cost and the environment. Also, things like dry tailings and dry stackings will be the future of mining, as they require less resources.

Generally, FLSmidth is investing heavily in automation and advanced process controls through our automation group. Our organization has set clear targets in this regard and we will have a chief digital officer to drive the implementation of these solutions.

Tuncay Özeren

Regional Sales Manager
WEIR MINERALS

Weir Minerals recently underwent some reorganization. Could you provide an update on this?

Since January 2018, Weir Minerals has split itself into two regional groups: one part will cover all European Union countries and the other will cover non-EU countries. We are in the second part, called NATKA, which stands for North Africa, Turkey and Central Asia, with its global headquarters in Turkey. We are currently developing the office

to have managing directors, sales directors and a complete office. The reason behind this change is to promote decentralization and provide better service to customers.

In Istanbul we are looking for a bigger warehouse to extend our facilities and conduct both services and manufacturing and assembly, for products like pumps, cyclones and complementary items.

Could you give us more details about your products and services?

Weir Minerals, a public company listed on the stock exchange, has three divisions: minerals, power and oil and gas. On the dry side, Weir Minerals covers crushers and screens, high pressure grinding rolls, and we are developing our presence in the comminution market. On the wet side, we produce pumps, cyclones, cyclone clusters, valves, rubber hoses and mine watering hoses. Our core business is slurry handling or transferring activities. Now we are also producing cold and hot bonding rubber lining. For example, for

Anagold's project we sold a large volume of pumps, cyclones, screens and rubber lining. The pumps were manufactured in the UK, whereas cyclone clusters and rubber lining were made in Weir's facility in Turkey.

What do you see as your main competitive advantages in Turkey?

Weir Minerals' focus in Turkey is on local sourcing. Turkey is like the China of Europe – you can manufacture everything and with better quality. Currently, we bring pumps from the UK and source parts like back plates, motor and motor support in Turkey, and assembly takes place here, which helps us reduce costs. Then, we cast the pump body in Turkey which helps us decrease cost as well. We do even better for cyclones: we ship individual cyclones from the UK but all the other pieces are manufactured here. So, 70% of cyclone clusters are nationalized in Turkey. Regarding slurry pumps, we are the leader, as we cover 70% to 75% of the market.

Given technological trends, how will mineral processing look like in five years' time?

The grades of mineral reserves are decreasing daily so new plants will grind more finely to liberate low-grade ores, increasing the importance of grinding circuits. 100 years ago, people would simply collect chromite from the ground, crush it and sell it as the grades were 50% to 60%, now they are around 5% to 8%. In the future, there will still be comminution, including a crushing and screening plant, but they will also include HPGR, ultra-fine grinding mills and other new technologies.

Regarding separation, flotation is also an important part of a processing plant, and more efficient flotation cells with our nextSTEP rotor/stator technologies will also be present. Furthermore, we cannot afford losing water. Now there are tailings dams in mineral processing plants but in the future, instead of building millions of cubic meters of tailings dams, dry stackings systems and tailings will be more common and this will save a lot of water resource. ■

We also manufacture watering screens in Turkey, and maybe one day we will manufacture Trio screens and crushers here. All the big players like Sandvik, GE, Metso and Outotec, are getting most of their equipment manufactured in Turkey, as heavy industry has moved from Europe to Turkey.

Is cost still the main driver for mining equipment in Turkey?

It used to be but this is no longer the case. Presently, Turkey is highly dependent on natural gas to generate electricity (up to 70%) but there are many investments into the energy sector that will reduce this cost. Customers are increasingly prioritizing solutions for increasing turnover and increasing capacity.

At Weir, we are investing in changing our strategy from selling individual equipment to providing solutions. We identify customers' needs such as increasing capacity, turnover and better service. Customers do not want to deal with individual suppliers and want a partner who can provide a performance warranty. ■



Mert Katkay

Sales Manager
METSO

Metso is a leading provider of crushing and grinding mills. What are its main activities in Turkey?

Metso has combined the expertise of different companies it has acquired, like Svedala, Nordberg and Allis-Chalmers. We have been serving the market in Turkey for more than 20 years. Our core business areas are mineral processing technologies and plants, such as crushing and screening, grinding mills, flotation cells, magnetic separators, dewatering equipment and complete mineral processing plants.

Miners are facing more complex geology and ore grades are not as high as before. How does Metso help ensure maximum performance?

We offer new technologies like stirred mills (SMD and VTM), high pressure grinding rollers (HRC) and advanced process controls (APC). Our APC technology is mine to mill as we can observe the mineralogy of the ore in each drill, and with instant chemical analysis through online stream analyzers customers can change the parameters of flotation cells, even before processing. This enables very effective plant operations and improved recovery and efficiency. We are also digitalizing all our equipment and we have already started with our mobile jaw crushing plants.

Ten years ago, most companies, especially mid-tier and larger, preferred to buy individual equipment from different providers. However, now these companies prefer to buy all their equipment from one company, such as Metso, so that they can be sure they are in safe hands financially and for technical solutions. We serve more than 50% of our customers' packaged needs.

Turkey is a hub for mining equipment manufacturing. What is the extent of Metso's local manufacturing in Turkey?

We are proud to be part of this success in Turkey. Metso manufactures items in Turkey for the Turkish market and elsewhere internationally. For example, we manufacture flotation equipment and distribute it all over the world. We manufacture products here on a project basis, and will take on a project if the location is advantageous. Metso manufactures flotation cells, grinding mills, shells, magnet separators and other big items in Turkey. Generally, we prefer to manufacture in locations which have expertise in a technology, so Metso's operations in Mâcon in France, Tampere in Finland and in the United States produce crushers and screeners. It is not cost affective to make whole crushers and screeners in Turkey.

In the last three years, our procurement figures have been bigger than our sales figures; in 2016, for example, total procurement was around US\$50 million and our sales were US\$40 million. Therefore, Metso is a local, Turkish company, just as much as an international company.

Why are more companies choosing to manufacture equipment in Turkey?

Because Turkey has well educated and talented people. It is like a European China but with better quality and human resources. Secondly, it is very cost effective compared to other parts of Europe, but offers the same quality. This is the case even considering the high electricity costs in Turkey.

How will Metso's business in Turkey evolve going forward?

We want to contribute to a sustainable mining business in Turkey, such as through installing APC and more efficient processes for our customers. Metso has proven technologies but another milestone for us is installing new-generation technologies in Turkey. ■

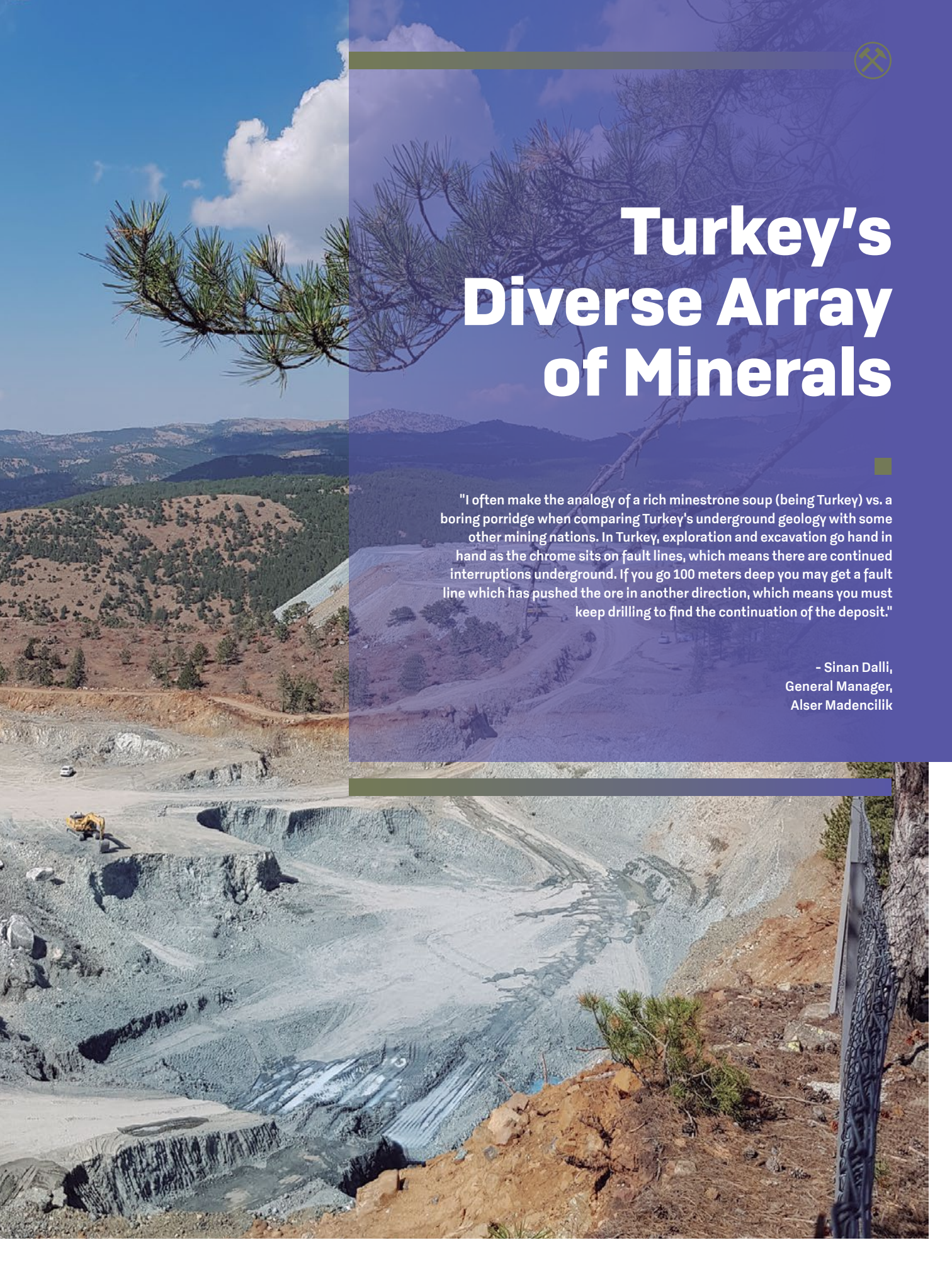




Turkey's Diverse Array of Minerals

"I often make the analogy of a rich minestrone soup (being Turkey) vs. a boring porridge when comparing Turkey's underground geology with some other mining nations. In Turkey, exploration and excavation go hand in hand as the chrome sits on fault lines, which means there are continued interruptions underground. If you go 100 meters deep you may get a fault line which has pushed the ore in another direction, which means you must keep drilling to find the continuation of the deposit."

- Sinan Dalli,
General Manager,
Alser Madencilik



Small but Packs a Punch

Turkey's high-grade deposits across diverse minerals

The world did not give Turkey a bounty of any one or two minerals, it is no Chile with its copper, for example, but it did give it an incredible diversity of minerals. While gold may steal the limelight, and coal is assuming more importance as Turkey aims to become more energy self-sufficient, the country has a thriving industry in a plethora of other minerals. Not only does Turkey have significant mining activities in more standard commodities such as copper, zinc and nickel, but it also is a world leader, and strong export player, in less renowned minerals like boron, trona, magnesium, and chromite.

A common pattern emerges across Turkey: other than for gold, it has no projects with large mineral reserves (by international standards) but instead small projects with often very high-grade deposits. "Turkey is located on the Alpine-Himalayan belt, a quite active tectonic zone. The location of the country resulted in the formation of many different medium and small sized ore deposits that usually have complex structures," explained T. Kemal Türeli, mineralogist and petrographer of Argetest Mineral Processing, R&D and Analysis Services.

High grade zinc for global markets

Turkey's zinc potential is a good example of this phenomenon. Through a 50:50 joint

venture with Akmetal AS, Pasinex produces direct shipping ore at its Pinargozu mine in the Adana province, southern Turkey. It is the highest-grade zinc mine in the world. "We have three different ore bodies: oxide, sulfide and mixed. The oxide ore body is on average 35% Zn, which is very high," explained K. Soner Koldas, country director, Pasinex. Yet, with a predicted 200,000 mt reserve, as per the mineral resource estimate of June 2017, the deposit is small. By comparison, the top four producing zinc mines in 2015 all mined more zinc than the entirety of Pinargozu's total deposit.

In another example, Meyra, part of the Delta Group conglomerate, has a proven 4 million mt lead and zinc deposit in the Bursa province, although it believes it could be much bigger and therefore very significant for Turkey.

As is so often the case in Turkey, miners must go to great depths to recover Turkey's zinc reserves. Esan Eczacıbaşı opened the Balya Balıkesir zinc and lead plant in 2009, which has a total gallery length of 30,000 meters and is 700 meters deep, making it the deepest lead and zinc mine in Turkey. Despite this, the rise of the zinc price in recent years (although it has been declining in the last three quarters) has seen more interest in mining the commodity in Turkey, especially as chrome prices have faltered. Dedeman Mining, which began life producing high grade carbonate zinc and lead

ore from Kayseri and exporting it to world markets, plans to invest more in both lead and zinc production, eventually producing zinc ingots.

Chrome me a river: prices cause headaches

Turkey is much better known for its chromium production, which helps feed China's voracious demand for stainless steel, than for zinc or any other base metals. Here the pattern is not quite as neat, and that is good news for Turkey: Turkey not only has high-grade chromium, it has relatively large quantities of it. In fact, it is the fourth largest chromium producer in the world, with an annual production of around 2,100 mt in 2017. By comparison, South Africa's chromium production was 15,000 mt in 2017. However, while South Africa has huge reserves and big mines, its chromium has a lower chrome to iron ore ratio compared to Turkey's.

There is still the sense that Turkey's mineral endowment in chrome makes it a smaller but tastier fish. Again, this is due to Turkey's geology. "In South Africa, Australia or Canada there are large basins of deposits for different types of metallic ores and once you have done the drilling and defined reserves with 3D measurements, it becomes only a matter of excavation. I often make

the analogy of a rich minestrone soup (being Turkey) vs. a boring porridge when comparing Turkey's underground geology with some other mining nations. In Turkey, exploration and excavation go hand in hand as the chrome sits on fault lines, which means there are continued interruptions underground," regaled Sinan Dalli, general manager, Alser Madencilik.

Alser, also part of the Delta Group, has discovered the largest lumpy chrome ore deposit in Turkey in the last 20 years. With the mine producing chrome ore of between 42% and 50%, it is particularly significant for Turkey because it was found in the west of the country where the conventional wisdom had been that the ore was of lower grade. "We have only drilled 20% of the prospection area so there is huge potential. The deposit can become a replica of the Elazığ area in eastern Turkey," continued Dalli.

Eti Krom, which Turkish conglomerate Yildirim Group purchased in 2004, is the world's biggest hard lumpy marketable chrome ore producer and has pumped much

investment into Turkey's chrome and ferrochrome production. Yilmaden, Yildirim's mining and metals holding company, now operates in multiple countries including Russia, Kazakhstan, Sweden, the US and Colombia. "Our Turkish business has continued to flourish, and we are now thinking about increasing our production volumes at Eti Krom's mines," remarked Alp Malazgirt, CEO, Yilmaden Holding. "This year we are carrying out pit optimization at Aladağ near Adana where there are a lot of chrome reserves. This involves much computer modeling and simulation and, based on this, we will be able to start planning the mine. It will require millions of dollars of investment in Turkey."

Overall, the market has been far from rosy for chrome producers in recent years due to volatile global prices and this has stalled further investments. Lower chrome price, caused by less demand from China, has induced some Turkish producers to downplay their high-grade chrome assets. Alser purchases lower grade material from other mines in the region and blends them with its

own production to achieve a better volume/price equilibrium. Meanwhile, Marmotek Madencilik, which produces high grade lumpy and concentrate chrome ore at its Denizli/Beyağaç site, is updating its concentrate facility to produce low siliceous and fine grain chromite which is suitable for the ceramics and glass industry, and foundry sand.

Turkey is also making strides to vertically integrate the supply chain to produce more ferrochrome, following in the footsteps of other top chrome producers South Africa and Kazakhstan. Currently, Turkey has two ferrochrome facilities, one in Elazığ and another in Antalya. "These facilities are strongly affected by electricity prices, which is why the government is prioritizing coal power plants," said Baris Sokmen, deputy general manager of chrome producer Madkim.

Dedeman Mining plans to up Turkey's game in ferrochrome production. "We would like to increase the volume of our chrome production from 50,000 mt/y to 150,000 mt/y. We plan to invest in drilling

ALSER
mining

**GROWTH THROUGH EXPLORATION
AND BEST OPERATION PRACTICES**

Alser Madencilik is amongst the top 3 mining companies in Turkey producing lumpy chrome ore from our underground galleries as well as open cast operations. We have various types of grades beginning from 32% up to 48% at our Tefenni/Burdur pits. We are able to enrich our ROM and produce tailor-made solution thanks to our sorting and jigging facilities. We are able to offer different sizing options ranging from lumps 32%-48% (25mm-300 mm), jigs 34%-48% (4mm - 25mm) and fines/concentrates 42%-50% (0mm-10mm). All of our products have high Cr:Fe and MgO:Al₂O₃ ratios. Alser Madencilik continues to invest at full throttle in order to achieve an annual 100,000 tons of lumpy and concentrates. (info@alsermaden.com)

In addition, Delta Star, the group trading arm is a well-established household name in supplying all kinds of chrome ore globally, with a proven track-record to meet its clients specific demands. (trading@deltastar.com.tr)

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www.alsermaden.com

Delta

Image courtesy of Alser Madencilik



used in helicopters, light armored vehicles and bulletproof vests due to its low density and high heat resistance. Speaking at the award ceremony of the MoU, former Energy and Natural Resources Minister Berat Albayrak (now Minister of Treasury and Finance) remarked: "Boron carbide is worth 2,000 times more than regular boron. A tonne of boron is worth US\$200, but once it is processed into a high-tech product, the value increases to nearly US\$400,000."

Turkey also aims to produce boron nitride, which currently sells at around US\$50,000 per tonne and could be used in atom reactors, aircraft and rocket engines due to its high-temperature resistance and high electrical insulation properties.

Another niche area where Turkey makes an impact on international commodity markets is magnesite and derivative magnesia. Most magnesia producers in Turkey focus on deadburned magnesia, which is used in refractory applications for basic bricks and granular refractories and is the most suitable heat containment material for high temperature processes in the steel industry. Caustic calcined magnesia (CCM) is also found in Turkey, a product more used in agricultural and industrial applications. Akdeniz Mineral Resources is the largest exporter of CCM from Turkey and one of the few producers of natural magnesia, which makes its material very pure with rates at 98%. "Mainly we produce CCM for hydro-metallurgy, and besides that, electro-fused magnesia (EFM), catalysts, water treatment, agriculture and animal feed," explained Akin Bayazit, sales and marketing manager of Akdeniz Mineral Resources. "We export almost 85% of our products. Our main export market is Africa and we also send products to United States and Central Europe, as well as small amounts to Asia and Oceania."

Turkey has deep potential across a staggering array of minerals, and likely there are more highly rich, if not huge, treasures to be found beneath its surface, for example in rare earths that will be in high demand in the world economy of the future. It is a geologist's dream, or nightmare, depending on one's perspective, which makes it vital that Turkey attracts the best expertise available to make the most of its mineral wealth. ■

between 800 meters and 1,000 meters in depth to find new reserves and increase our production. As a final stage our target is to produce ferrochrome," said Yunus Soysal, technical group director, Dedeman Mining.

Turkey's niche minerals

Turkey also holds rich deposits in minerals used in niche applications and which command a high price on global markets. The unsung hero of Turkey's mining industry is boron - Turkey is the largest producer of refined boron products globally. With 3.3 billion tonnes of reserves, representing 73% of the global total, it also has the largest boron deposits in the world. Boron is mostly used in glass (such as insulation type fiberglass, textile-type fiberglass, borosilicate glass and glass panels), ceram-

ics, agricultural and detergent-cleaning industries. Looming large in this niche is state-owned Eti Maden, which strikingly met 57% of the world's boron demands in 2017. The largest deposits are in Eskişehir-Kırka, Kütahya-Emet, Bursa-Kestelek and Balıkesir-Bigadiç. Eti Maden and the MTA carried out a major exploration program as part of the Boron Master Plan between 2002-2013, increasing reserves by 1.3 billion tonnes. More exploration is ongoing, particularly to determine the potential of the Bigadiç basin.

Refined boron products promise to be a boon for Turkey's economy going forward. In June 2018, Eti Maden and China's Dalian Jinma, a world leader in boron technology, signed a MoU to develop a high-tech boron carbide production facility in Balıkesir, western Turkey. Boron carbide is highly sought after in the defense industry, being



K. Soner Koldas

Country Director
PASINEX



The oxide ore body is 35% Zn, which is very high. It is direct shipping ore; we do not have any chemical processing facilities – we do just mining, classification and sorting and then selling. Therefore, it is also an environmentally friendly operation.



Is it still difficult to obtain forestry permits?

The situation has not changed and it is one of our main challenges, as without a permit you cannot do drilling and expand your mi-

What was the performance of the Pinargozu zinc mine in 2017?

The project has been very successful with a profit of US\$1.58 million in 2017 and we became the highest tax paying company from the mining sector in Adana. We have more than 200 people employed in our project, both locals and expats and it is a role model operation. Our success is down to our team and our ore resources. We have had good planning and strategy and completed our NI 43-101 report last year. Zinc prices have also been favorable.

We want to have a bigger zinc operation and our strategy is to acquire more land and make joint ventures with other companies. We keep ramping up our production and plan to increase it next year as well. Also, we are not only doing mining but also exploration. We are drilling 20,000 meters both underground and at surface and we have so far defined the resource using various techniques from satellite imagery to GIS; this approach has also been key to our success.

Compared to other zinc producing mines in Turkey, what are the advantages of the Pinargozu mine and could you tell us more about Pasinex's exploration plans?

The grade is higher, and we have three different ore bodies: oxide, sulfide and mixed. The oxide ore body is on average 35% Zn, which is very high. It is direct shipping ore; we do not have any chemical processing facilities – we do just mining, classification and sorting and then selling. Therefore, it is also an environmentally friendly operation. We are also selling concentrate and our sulfide grade is high at 45% Zn.

We have identified a 10-km zone which is open at depth and along strike, where we must do more drilling. Our JV company Horzum (50:50 with Akmetal) holds three licenses and we are extending our ore zone in the Akkaya and Pinargozu licenses. We are using geophysical geochemistry techniques to identify the deeper section of the ore body.

ning operation. It used to take a couple of weeks but now it takes years; it is a terrible situation and we hope that it will change in the near future.

The Soma mine disaster had a big impact on the sector. What safety standards does Pasinex have in place?

Firstly, we have semi-mechanized mining in the development and stoping phase. Secondly, we have a zero-tolerance approach for safety, health and the environment; we do not accept any sub-standard conditions and acts, and employees must report any incident and accident including near misses immediately. We have safety managers and engineers, and a surveillance monitoring system working underground. Pasinex continuously trains and educates its labor force, has put a safety culture in place, and applies both local and international standards. So far, we have had no fatalities and we hope this will continue. Continual safety awareness is very important and it is a topic of discussion at the beginning and end of every shift.

What is your outlook for the Turkish mining industry and foreign investment?

I am bullish on the future for mining in Turkey. We have a pro-mining government and support from mining department MİGEM. This country needs to attract more mining and foreign investments, so the mining sector can build a better future for all concerned. The potential is so high because Turkey is on the Tethyan Metallogenic Belt and although there is not a huge world-class deposit, there is everything from gold and base metals to coal. The government must be able to use this wealth.

Foreign investors are crucial for more mining developments in Turkey. They have brought many technologies, human resources, guidelines and education. Thanks to foreign mining companies we now have more skilled mining professionals and technical persons in Turkey. Turkey has become the biggest gold producer in Europe because of foreign investment and it benefits greatly from mining activities and operations. In this context, Pasinex's mission to become the biggest base metal company in Turkey. ■



Alp Malazgirt

CEO
YILMADEN HOLDING

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In September 2016, we acquired the leading producer and toll processor of high-grade ferrovandium (FeV) and ferromolybdenum, Bear Metallurgical Company, based in the US. We also acquired a massive coal reserve of 740 million mt in Colombia.

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In 2014 Yilmaden had just acquired the Voskhod mine in Kazakhstan and the Tikhvin ferroalloy plant in Russia from Mechel. What have been the main updates since then?

The investment turned out to be a spectacular success in terms of the product, technologically and operationally. When we took over the Voskhod mine, production was at about 700,000 mt/y and we have increased this to about 1 million mt/y; at the ferrochrome plant we have increased the furnaces to three and are thinking about increasing production with a fourth furnace. We have also gone from only a few products to five or six different ferrochrome products. Meanwhile, our Turkish business has continued to flourish and we are now thinking about increasing our production volumes at Eti Krom's mines. In September 2016, we acquired the leading producer and toll processor of high-grade ferrovandium (FeV) and ferromolybdenum, Bear Metallurgical Company, which is based near Pittsburg, United States. So, we increased the scope of our operations. We also acquired a massive coal reserve of 740 million mt in Colombia.

What are Yilmaden's investment plans in Turkey going forward?

We have increased our exploration activities and have a big drilling program in place. We have done about 5,000 meters of drilling this year already and we will continue to do more. Recently, we struck lead and zinc in Tufandeyli, in the Adana province. This year we are carrying out pit optimization at Aladağ, near Adana, where there are a lot of chrome reserves. This involves much computer modelling and simulation and, based on this, we will be able to start planning the mine. It will require millions of dollars of investment in Turkey. We have already increased our staff in Yilmaden's Istanbul headquarters, adding many geologists, geochemists, geostatisticians and mining planners.

Why has foreign investment into Turkey dropped since 2014?

There were many environmental and social challenges, such as the difficulty in getting environmental permits, which meant Turkey went through a quiet period and some foreign companies pulled out. Companies really need to be in a niche market when making investments in Turkey; chrome and

gold, for example, are a good investment but nickel, iron and coal may not be unless the prices are right.

Yilkrom, also part of the Yilmaden Holding, is a partner for local and international investors. Why should they collaborate with this company?

Yilkrom has many licenses in the Elazığ area in eastern Turkey and therefore can be a good exploration partner and help turn mineral wealth underground into something valuable. Also, it is a good company to work with because of our mineral expertise in the beneficiation of chrome and metallurgical smelting. We also have an aggressive plan to go after licenses in Turkey.

Ferroalloys are expected to be a US\$65 billion market by 2024. What are the main drivers of this internationally?

Chrome is irreplaceable as it adds corrosion resistance to iron and steel, making it stainless steel. Underlying this, there is big appetite for stainless steel from China, India and the other big developing countries. In this context, Yilmaden's strategy is not to be in the commodity or charge chrome market but to build niche ferrochrome products which demand a premium price.

Beyond your recent acquisitions, is Yilmaden looking to further expand internationally?

We have dabbled in Africa because South Africa and Zimbabwe have large chrome reserves. We recently devised a plan and chrome will be at the top of the list, but we will also explore for lead and zinc. In Kazakhstan we have the experience, know-how and familiarity with the market and will continue investing there. Recently, we have started investing in Uzbekistan and signed a contract with KazGeology, and a MoU with the geology ministry. In all these countries we have very extensive, high potential and well-funded exploration projects.

On the metallurgical front, we are still looking for opportunities for chrome and other metals. We have spent much time considering vanadium sourcing because of our ferrovandium and ferromolybdenum factory in the United States. We are scouring the face of the earth for these be it mud, slag or solution or in mineral form, and our mergers and acquisitions team is engaged in talks in South Africa and the United States. ■



Sinan Dalli

General Manager
ALSER MADENCILIK

Most deposits have been exploited using surface mining but this is extremely risky because once the surface level is excavated, all the data about a potentially much larger deposit is lost and, as the cost of production rises, developers lose interest but ten years later no one knows mining took place there.

What have been some of the milestones since Delta Group acquired Alser in 2013?

Delta is new to the mining world and entered the industry in 2013. Chrome is our first area of focus in mining but we have also started to look at lead, zinc, gold and copper. Regarding our chrome deposit we spent our initial capital on exploration drilling. So far, we have done about 25,000 meters of drilling, which is substantial in an area of 890 hectares. We have discovered the largest lumpy chrome ore deposit in Turkey for the last 20 years. This is particularly significant because this part of Turkey was regarded to have lower grade chrome. We have only drilled 20% of the prospectation area so there is huge potential. The deposit can become a replica of the Elazığ area in eastern Turkey. We have a couple of galleries where we immediately started production and have generated cash flow.

Where does Alser's chrome production fit into the chrome value chain?

We are an independent player that produces for trading purposes. Alser has a diversified base of clients in locations like China, the Middle East, the UK, Germany and Sweden. Our products are of premium quality. However, chrome prices are volatile so we also acquire lower grade material from other mines in the region and have a blending operation to achieve a better volume/price equilibrium. We are now the largest trading company in western Turkey. Currently, we produce about 6,000 mt/y to 8,000 mt/y of lumpy chrome ore ranging from 42% to 50% grade from our own mine, and 15,000 mt/y of trade material from third party providers.

Turkey has higher grade chrome compared to other major produces like South Africa. What makes the geology in Turkey special?

The geology in Turkey is very young and it is still evolving, as such it has a fragmented geology. In South Africa, Australia or Canada there are large basins of deposits for different types of metallic ores and once you have done the drilling and defined reserves with 3D measurements, it becomes only a matter of excavation. I often make the analogy of a rich minestrone soup (being Turkey) vs. a boring porridge when comparing Turkey's underground geology with some other mining nations. In Turkey, exploration and excavation go hand in hand as the chrome sits on fault lines, which means there are continued interruptions underground. As a result, drilling requirements are ongoing throughout the project life while the ore deposits are close to the surface and the grades are higher due to it being a volcanic zone.

What is Alser's timeline for investments to increase production and reserves?

When we started we had the goal of 100,000 mt/y of chrome sales within three years and we have achieved that. Now we plan 150,000 mt/y of production from our own mine next year. We will spend most capex in exploration and acquiring new licenses. Alser is pursuing a 'hub mining' strategy where we leverage our existing people and equipment and acquire licenses which have synergies to reduce our cost of production. We will probably invest \$50 million to \$100 million in new licenses over the next three years and our capex spending for infrastructure and equipment will be \$15 million to \$20 million. Additionally, we need to do 100,000 meters of drilling over the next four years, costing about US\$10 million.

Why has there not been more chrome production in western Turkey already and what is your outlook for mining in Turkey generally?

Historically, most of the drilling activity in Turkey has been done to discover coal rather than metallic deposits. Chrome deposits have mostly been found sporadically, such as when a farmer brings a piece of material to a municipality office. Most deposits have been exploited using surface mining but this is extremely risky because once the surface level is excavated, all the data about a potentially much larger deposit is lost and, as the cost of production rises, developers lose interest but ten years later no one knows mining took place there. Therefore, there needs to be a joint effort by government and private industry to do longer and deeper drilling with long-term planning. ■

Cansu Çopuroğlu

Sales and Marketing Director
MARMOTEK MADENCİLİK



Could you provide an update on Marmotek's operations?

At present, Marmotek is actively operating chromite mines, as well as copper, lead and zinc mines. The Denizli/Beyağaç chrome site is our main production project and we have been producing high grade lumpy and concentrate there since 2015. We have successfully completed surface exploration at the Eskişehir chrome site and are aiming to operate the mine and start production in 2019. Regarding the copper, lead and zinc mine in Çanakkale, Çataltepe region, our mine became operational in Q4 2017.

What are the main advantages of Marmotek's chromite?

The qualifications of the chrome ore we are producing in our Denizli underground mine pit are as follows: min. 52% Cr₂O₃, chrome iron ratio (Cr / Fe) 3.8%, less than 4% SiO₂, and size at 0-10 mm is 10%. Many ferrochrome plants are interested in our lumpy and concentrate due to its specifications. Since we are well aware that ferrochrome plants are changing their production structure with new technology to use more con-

centrate and fine, we are also altering our production structure to produce that. Also, we are updating our concentrate facility in Denizli to produce low siliceous and fine grain chromite which is suitable for the ceramics and glass industry, and foundry sand.

How do you ensure high safety standards?

Before all our employees get started, they are provided with the detailed information about the work to be done and undergo occupational training. PPE (personal protective equipment) is given to them in accordance with the work to be done. In order to ensure safe operations for our underground workers, the furnace is constantly ventilated, and gas measurements are made and recorded by responsible mining engineers at every shift. In case of emergency, there is an emergency path established from the entrance of the quarry to the working areas. Our employees are followed with personnel monitoring systems and the possible negative effects are immediately intervened upon. The main principle of our company is that "Nothing is More Important or Urgent Than Work Safety." ■

Baris Sokmen

Deputy General Manager
MADKIM



Madkim produces chromium concentrates and lumps and magnesite. Could you introduce its history?

Initially, Madkim was focused on magnesite production and raw material for the USSR and Greece. Additionally, it has always produced aggregate material for the construction sector, where there is always demand in Turkey. We used to have royalty agreements for quarries but now we have our own license in Danamandıra, just outside Istanbul. Since 2001 we were mostly focused on iron ore and partnered with Demir Export for ten years in Sivas. Demir Export also has chromium fields in Bursa and from 2007/8 we refocused our activities here. We brought the licenses from Demir Export in Bursa and have our own enrichment plant there as well, and we sell chrome concentrate. We are less involved in iron ore now, although we have some licenses in Kayseri.

What are the main benefits of your chrome assets?

The licenses we acquired are vast and rich, and chrome has been extracted from them since before WWI. It is classic Turkish chrome and, although the richest reserves are now finished for Madkim, we have upgraded

our plant to handle more chrome ore feed and keep production at the same level. South Africa, the largest chrome producer, has huge reserves and many big mines but the chrome/iron ore ratio is low, whilst in Turkish mines it is higher. There are also emerging chrome markets like Zimbabwe and Albania but their infrastructure is not good there.

Most of the material goes to China so it is important to be close to ports. South Africa is also now producing ferrochrome and Kazakhstan produces ferrochrome from its chrome reserves. Turkey has two ferrochrome facilities: one in Elazığ and another in Antalya, which are very old and are strongly affected by electricity prices, which is why the government is prioritizing coal power plants.

What are your plans for sepiolite?

We want to enter the industrial materials market with sepiolite, which is a rare material. There are reserves only in Spain, Turkey, and some in Morocco and United States. The technical grade is even more rare but we have it in Turkey. We have had licenses for sepiolite mining since 2000 and currently we are waiting for chrome prices to recover before we make an investment in sepiolite. ■

Yunus Soysal

Technical Group Director
DEDEMAN MINING



What have been Dedeman's major accomplishments since it established chrome mining operations?

The first mining operations in Turkey were conducted by Dedeman. The late Mr. Kemal Dedeman started the mining operations 1947 in Pınarbaşı, Kayseri. His first mine produced chrome. Later he added three more mines and increased production from 3,000 mt/y to up to 150,000 mt/y. In the 1970s these mines were still ongoing, although the reserves started to be exhausted. Over the last 71 years, four to 5 million mt has been exported to global markets.

Our products are only found in specific areas of the world, as part of the special ferrochromium group. Right after it was founded, Dedeman also started to produce high grade carbonate zinc and lead ore from Kayseri, in the Aladağlar area. We were one of the first companies conducting exploration and after reserves started diminishing in Kayseri, we started to expand to other parts of Turkey. By 2013 we became one of the top three chrome miners in Turkey. Our main advantage is definitively our high grade minerals.

How does Dedeman plan to increase its chrome, zinc and lead production?

Due to market conditions in recent years, we decreased our chrome production and made more investments into our lead and zinc business, increasing our volume in these minerals. So, we went from producing 5,000 mt/y lead concentrate, to around 20,000 mt/y. We plan to increase our production by 30,000 mt/y to 50,000 mt/y in the next three to four years.

Recently, we started drilling studies once again for chrome. For example, we plan to invest US\$22 million in Adana and plan to increase production by 100,000 mt/y in 2019 and perhaps by 150,000 mt/y to 200,000 mt/y in the next two to three years.

What are Dedeman's core objectives in the years to come?

We would like to increase our lead and zinc production, but our ultimate goal is to invest in end products like zinc ingots. Also, we would like to increase our chrome production. As a final stage, our target is to produce ferrochrome. ■

Sumeyra Esgun

Founding Partner and General Manager
MEYRA



Could you give us the main highlights of Meyra's lead and zinc project in Bursa?

We acquired the Bursa project in 2013, obtained the permissions within 15 months and then started to produce run-of-mine (ROM) sulfide lead and zinc ore which was sold to nearby flotation plants. In 2017 we drilled nine holes and cut ore in six drills and this year we plan to drill 2,000 meters. We have proven the deposit has 4 million mt of lead and zinc and we believe it is potentially 65 million to 80 million mt in size. Now we are awaiting permission for a flotation plant and have prepared a US\$6 million to US\$7 million capex, with a US\$4 million investment into the plant itself.

Other advantages of the deposit are that it is near Istanbul and the port of Gemlik, and the mineralization of the ore is very simple, it can float very easily, leaving gangue minerals at a rate of 300 microns. In early 2018 Delta acquired 60% of the shares of Meyra which is very useful given the potentially huge size of the project and Delta's high capital capacity.

Do you expect zinc fundamentals to remain favorable going forward?

After we receive permission for the flotation plant, we will establish a plant and aim to

sell to lead and zinc smelters internationally, particularly in China. Galvanization rates are increasing and zinc is being used more for health purposes like Alzheimer's treatment.

What is your outlook for base metals in Turkey?

Turkey has very complex geology but there are enormous opportunities in base metals, especially for mid-sized companies. Therefore, foreign investment will likely increase in this area. Although, investment has slowed down recently due to the elections. There was a large investment in a copper mine and flotation plant in Kastamonu.

What challenges are there to operating in Turkey?

Engineering is not regarded highly enough in Turkey and it is very difficult to find mining talent, especially drilling professionals. The supplier base for drilling is not advanced enough and there needs to be more foreign players in the market that can drill to international, such as JORC, standards. Also, we are waiting for more operational legislation from the government. Currently we do not understand the mining regime completely as it is not clear. This reflects how Turkey is still new to mining. ■

Akin Bayazit

Sales and Marketing Manager
AKDENIZ MINERAL RESOURCES



What are Akdeniz's main activities in the Eskisehir area?

Akdeniz was founded in 1993, at which time the main goal was the production of raw magnesite. Akdeniz is the result of the first official Turkish-Greek joint-venture. Initially, we supplied raw magnesite to Grecian Magnesite but after further market investigations we decided to produce caustic calcined magnesia (CCM).

After our rotary kiln investment in 2011 we started broadening our market presence. Our know-how led us to specialize in high-quality magnesia from natural magnesite, with a purity of about 98%. Mainly we produce CCM for hydro-metallurgy, and besides that electro-fused magnesia (EFM), catalysts, and product for water treatment, agriculture and animal feed. We export almost 85% of our products.

How has the magnesia market performed since 2014 and what have been the main growth markets?

For the next ten years hydro-metallurgical applications are predicted to be the main growth driver. The usage of magnesium oxide in this sector started about ten years ago and is especially in demand from the Copperbelt area running between Zambia and DRC, where the

main hydrometallurgical producers are located. Magnesium oxide is also being used in the leaching process to produce nickel oxide.

China is reducing its magnesia production due to environmental concerns. Is this an opportunity for Turkey and Akdeniz?

Yes and no. For almost a year, we have been selling to China as the government there has put pressure on producers over environmental and health and safety concerns. There is a shortage of product in China and it cannot supply the international market. So, we are getting more demand from countries around the world. We have 42 km² of licensed land and we need to do more exploration to increase our capacity.

What else differentiates Akdeniz from other magnesia producers?

Magnesia producers in Turkey are mainly focused on deadburned magnesia (DBM). We are the leading CCM exporter in Turkey and have a few grades. Looking globally, we are also one of the few producers of natural magnesia, which makes our material purer. Additionally, we have installed a gas pipeline, so we can use natural gas to burn our product which keeps out impurities. ■

Handan Bozbağ & Talat Şenkal

HB: Chair of the Board
TŞ: Honorary Board Member
BARIT MADEN TÜRK



HB



TŞ

How does Barit Maden differentiate itself from competitors in industrial minerals and gases?

TŞ: We produce a range of high quality barite products that serve various global industries, namely oil and gas drilling, chemicals, paints, automotive and pharma. The industrial minerals market has so much potential; along with our R&D efforts on celestite, we also pursue new potential uses for barium sulfate in the construction market and B2C opportunities. Decades of know-how on the formation of barium sulfate give us the necessary scientific data and a much-valued intuition required for optimum exploration outcomes.

We have been in the industrial gases market for over twenty years. We have a dedicated quality team and technological tools working around the clock to assure the best quality that we can offer at this day and age. Our customer feedback is proof of the excellence of our ability to meet service demands from A to Z. Our experienced teams handle all operations; we do not believe in outsourcing services that are directly related to our products. Logistics and the strategic locations of our

production facilities are among our strengths. Our main growth markets are in the MENA and Eurasia regions. Close proximity of international ports tailored with various shipment alternatives enable us to better meet our customers' transportation needs around the world.

What are the core objectives for Barit Maden Türk in the next few years?

HB: Barit Maden's R&D department is conducting research on all areas of utilization and new means of production to increase efficiency along with product variety. It is of great importance to us that we achieve the highest possible efficiency in our production processes so that we maximize our output and minimize our waste. The respect we feel when we think about the millions of years required for the formation of our natural resources, obliges us to optimize all key activities from exploration to packaging. As our founder Mr. Bozbağ used to say: we cannot give these resources back to nature, so we must be respectful and use every single particle, create high added value with respect to human effort. ■

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THANK YOU

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TURKISH MINERS ASSOCIATION

tmdr.org.tr/en

TURKISH GOLD MINERS ASSOCIATION

turkishgoldminersassociation.org

TURKEY MINING DEVELOPMENT FOUNDATION

ymgv.org.tr

GENERAL DIRECTORATE OF MINERAL RESEARCH AND EXPLORATION (MTA)

mta.gov.tr

TÜYAP

tuyap.com.tr/en

"In the past, the public has been misled about mining activities (particularly confusing gold exploration with production) by opponents of mining. Mining activity, in general, must take place where the ore is, and in countries around the world, like the United States, Canada, Russia, Scandinavian countries and Australia, it happens in forestry areas as well. Whilst there may have been some environmental concerns previously, now gold mining activities in Turkey have international standards."

■ **- Tamer Gezbul, Board Member,
Invictus Mining**

The public does not fear the use of cyanide in gold mining as much as in the 1990s as they have become more informed about its usage. We try to inform the public during our EIAs and public information meetings about its safe usage. The Turkish Gold Miners Association also informs the public about the use of cyanide.

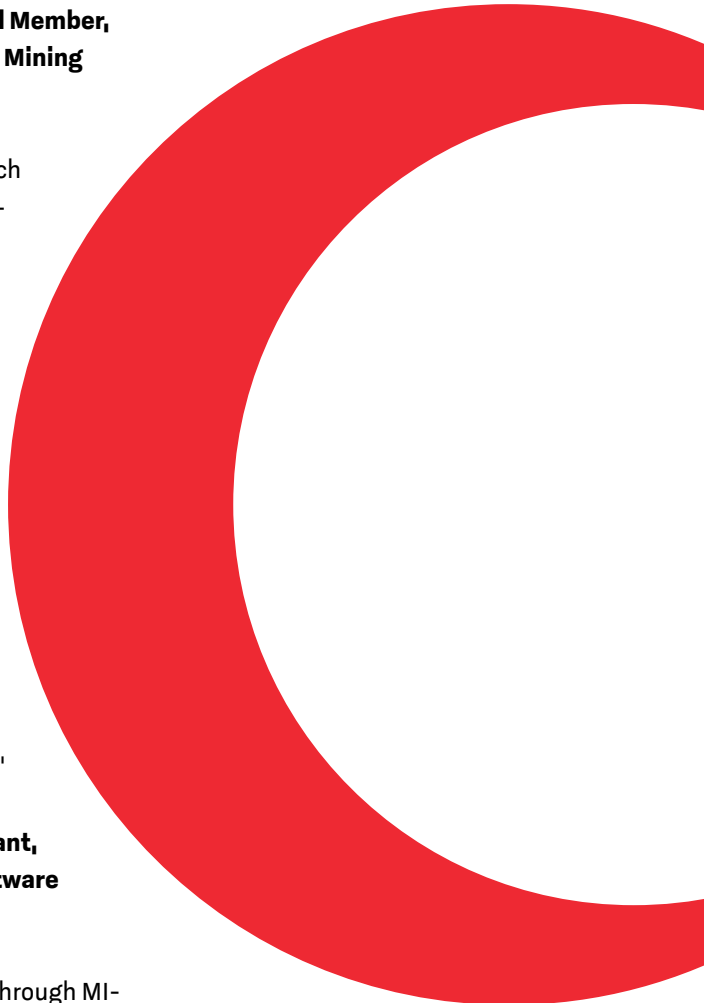
■ **- Ahmet Oguz Ozturk, Director,
SRK Turkey**

64 ■ "The new regulations require resource modelling preparations and reserve calculations as per international standards. Turkey has a new standard called UMREK, a national resource and reserve reporting committee, which is now connected with the Istanbul Stock Exchange. After this, SMEs, who unlike most larger companies did not adopt international standards, will be required to do so."

■ **- Oğuz Turunç, Senior Consultant,
Datamine Software**

■ "Theoretically private companies can make land acquisitions through MIGEM, but in practice it is difficult. Therefore, they do it by themselves via a bargaining process with the owners. This is not involuntary land acquisition, in fact, but a voluntary selling of the land. In order carry out the compulsory land acquisition process, one must receive a public benefit decision from the board of ministers for the project. However, a private company cannot get this authorization, and therefore a public entity must do so on behalf of investors."

■ **- Tolga Balta, Managing Partner,
Encon Environmental Consultancy**



"Metal mine projects are quite different than coal projects where the government auctions tenders to build power plants by operating the related coal mines and compulsory land acquisition becomes more straightforward, as the energy facilities are regarded as public benefit projects."

**- Haluk Çeribaşı, Managing Partner,
Encon Environmental Consultancy**

"The undersecretary of the Ministry of Energy is trying very hard to increase foreign investment and the Turkey brand will be back on track again for mining. As well as tax breaks, incentives for final products such as boron salts, soda ash and base metals, make investments in both mining and metallurgical studies in Turkey attractive."

**- Tamer Gezbul, Board Member,
Invictus Mining**

"Turkey implemented a new scheme covering project-based incentives for investments which is specifically designed for projects above \$100 million. Under this scheme the Ministry of Economy will work with entrepreneurs to design a tailor made incentive scheme for the project."

**- Fatih Kaya, Senior Consultant,
Invist FC**

"In Turkey there are 37 geological engineering departments but, over the last couple years, only five to seven of them have been able to get students, because it is more popular to be a doctor or a computer, industrial or mechanical engineer. Also, students tend to choose based on their success rate in the examinations, and geological engineering does not require as high a success rate as other subjects, due to lack of demand."

**- Erdin Bozkurt, Department of Geological Engineering,
Middle East Technical University (METU)**



COMPANY/ INSTITUTION

WEBSITE

Producers

Akdeniz Mineral Resources	akdenizmineral.com.tr
Alamos Gold	alamosgold.com
Alser Madencilik	alsermaden.com
Anagold Madencilik	anagold.com.tr
Barit Maden Türk	baritmaden.com
Çayeli Bakır	cayelibakir.com
Dedeman Mining	dedemanmaden.com
Ekin Maden	ekinmaden.com.tr
First Mining Madencilik	firstmining.com.tr
Galata Madencilik (Ariana Resources)	arianaresources.com
Kilazzi Holding	kilazzi.com
Madkim Maden ve Kimya San. ve Tic.	madkim.com.tr
Marmotek Madencilik	marmotek.com.tr
Meyra Mining	deltastar.com.tr
Öksüt Madencilik (Centerra Gold)	oksutmadencilik.com.tr
Pasinex	pasinex.com
Su-Taş Madencilik	su-tas.com
TÜMAD Madencilik	tumad.com.tr
TÜPRAG Metal Madencilik	tuprag.com.tr
Yilmaden Holding	yildirimgroup.com

Mining Services

CH Consultants	chconsultants.com
Datamine Software	dataminesoftware.com
DMT Turkey Branch	dmt-group.com
Encon Consultancy	encon.com.tr
Encon Laboratory	enconlab.com.tr
Golder Associates	golder.com
Mitto Consultancy	mitto.com.tr
Ozifin Mining	ozifin.com
Proses Engineering, Consulting, Construction and Design Inc	proseseng.com
SAFEmap International	safemap.com
SRK Turkey	srkturkiye.com

This list intends to include just a representative sample of companies operating in Turkey's mining sector, and as such it should not be considered a guide to take investment decisions.

COMPANY/ INSTITUTION

WEBSITE

Technology and Equipment Providers

ENKA	enka.com
Epiroc	epiroc.com
FLSmidth	fismidth.com
Gursan	gur-san.com.tr
Metso	metso.com
Weir Minerals	global.weir

Laboratories, Inspection and Analysis and Mineral Processing

Alfred H. Knight	ahkgroup.com
Argetest Mineral Processing, R&D and Analysis Services	argetest.com
Bureau Veritas	bureauveritas.com.tr

Drilling Services and Equipment

Enerson Engineering	enersonengineering.com
Enmad Drilling	enmadrilling.com
Global Magnet Group	globalmagnetgroup.com
Kayen Drilling	kayensondaj.com
Ortadoğu Drilling	ortadogusondaj.com
Pozitif Drilling	pozitifsondaj.com.tr
Spektra Geotek	spektra.com.tr

Public Sector Organizations, Consultancies and Trade Associations

General Directorate Of Mineral Research And Explorations (MTA)	mta.gov.tr
Invist FC	invistfc.com
Ministry of Energy and Natural Resources	enerji.gov.tr
Turkish Gold Miners Association	turkishgoldminersassociation.org
Turkish Miners Association	tmder.org.tr
Turkish Mining Development Foundation	ymgv.org.tr



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