The consumption of sodium, sodium-potassium and sodium-magnesium feldspar has increased enormously over the last 20 years in parallel with the growth in world ceramic tile production. Due to their favourable characteristics, feldspars are widely used in the formulation of various kinds of ceramic bodies (white body single firing, glazed and unglazed clinker, white and coloured stoneware, and glazed and unglazed porcelain) and can account for up to almost 50% of an average ceramic body. Moreover, the strategic role of these raw materials is set to increase further due to the steady growth in large-size ceramic tiles, panels and slabs. Turkish feldspar is currently the main (if not the only) sustainable technical and economic compromise given its ability to lower the vitrification temperature of the ceramic material during firing by introducing low-melting alkaline elements (Na2O and K2O) into the body. The introduction of Turkish feldspar into the ceramic process allows the body raw materials to undergo a high degree of sinterisation at temperatures on average 150-200°C lower than would otherwise be necessary. Moreover, this material guarantees an extremely smooth vitrification curve free from sudden variations in shrinkage/absorption. It is therefore a vital component of the modern ceramic process where the use of increasingly rapid thermal cycles results in the need for higher performance bodies in terms of fusibility. At the same time it avoids having to resort to eutectic-forming raw materials, which while clearly lowering the vitrification temperatures are also associated with extremely irregular shrinkage/absorption curves that are difficult to manage in an industrial process, especially in the case of large sizes.

The role of Turkish feldspars in the production of glazed ceramic tiles and slabs

Il consumo dei feldspati sodici, sodico-potassici e sodico-magnesiaci è cresciuto negli ultimi 20 anni in modo esponenziale, parallelamente all'aumento della produzione mondiale di piastrelle ceramiche. Per le loro caratteristiche, infatti, i feldspati sono ampia mente utilizzati nella formula zione di svariati tipi di impasti - monocottura chiara, klinker smaltato e non smaltato, gres ceramico bianco e colorato, gres porcellanato tecnico e smaltato – arrivando a costituire fino quasi il 50% di un impasto ceramico medio. Il ruolo strategico di queste materie prime è inoltre destinato ad aumentare ulteriormente con la progressiva af fermazione di piastrelle ceramiche di grande dimensione e lastre. I feldspato turco infatti rappresenta ad oggi il principale (o unico) compromesso tecnico-economico sostenibile, capace di ridurre in cottura la temperatura di greificazione del materiale ceramico, mediante l’introduzione nell’impasto di elementi alcalini basso fondenti (Na2O e K2O). L’introduzione del feldspato turco nel processo ceramico permette il raggiungimento di sinterizzazioni spinte delle materie prime dell’impasto a temperature mediamente inferiori di 150 – 200 °C rispetto a quanto avverrebbe in sua assenza. Non solo. Garantisce anche una curva di greificazione particolarmente regolare e priva di improvvisi variazioni di ritiro/assorbimento. Si tratta quindi di un costituenti fondamentale per il moderno processo ceramico, dove cicli termici sempre più rapidi necessitano di impasti sempre più performanti dal punto di vista della fusibilità; questo senza ricorrere a materie prime formattori di eutettici che, a fronte di un evidente calo delle temperature di greificazione, comportano curve ritiro/assorbimento assolutamente irregolari e di difficile gestione industriale, soprattutto nel caso
Turkey is one of the world’s top producers of high-quality feldspar. Given that doubts have recently begun to emerge concerning the real availability of the reserves necessary to guarantee a supply of high-quality materials, we need to take account of the complexity of the feldspar production process as well as the enormous increase in consumption over the last decade.

The Turkish feldspar production process

The first step involves identifying and preparing the quarry site. Different deposits are generally used to achieve the desired quality in a shorter timeframe. The next step involves placing explosive charges and performing primary crushing with percussion hammers at the quarry to prepare the extracted material for transport to the secondary crushing plant. It is here that initial production takes place and after various laboratory tests the material is selected and divided up into standard categories of medium, high and very high quality. From these areas the materials are transported by truck either to the initial storage area (about three kilometres from the port of Gulluk) or to the plants for the enrichment processes, which involve mixing, flotation, dry or wet magnetic separation and milling. From here the materials are reloaded onto trucks and transported alongside ships ready for boarding.

Feldspar reserves in Turkey and mining operations

Almost 28 years have gone by since Turkish feldspar first arrived in Italy. Landing data reveal that in 1990 and 1991 ships
with a capacity of around 2,500 tonnes began arriving in Italy, taking up to 40-45 days for each shipment. Over the following years the loading capacity at the old port of departure improved steadily, allowing larger ships to be loaded. Volumes of Turkish feldspar offloaded at the port of Ravenna increased from 250,000 tonnes/year in the early 1990s to about 1,000,000 tonnes/year by the end of the decade.

Construction of the new port at Gulluk in 2010 and improved logistics gave fresh momentum to Turkish feldspar exports, which between 2010 and 2017 almost doubled from 3.6 million tonnes to 6.2 million tonnes (Table 1). In 2017 some 2,600,000 tonnes was shipped to Italy.

This sharp increase was driven by the growth in demand from the local and international ceramic industry for increasingly high-quality materials, in other words materials with a lower chromophore content and a higher alkali content. A number of Turkish mining companies responded to this growth in consumption with inadequate management of the deposits, leading to a depletion of the reserves and a significant decline in quality. As for volumes, this unsustainable growth in mining activities (further 5% growth is expected in 2018) has led to the exhaustion of numerous deposits and the closure of 11 companies (Fig. 1).

In terms of quality, it has reduced the availability of mass or standard feldspars with significant values of chromophores and alkalis. Lower quality materials are now quarried and selected than in the recent past, resulting in the need for enrichment processes which in turn require investments in new plants.

In this critical scenario, however, a number of companies have adopted more cautious industrial strategies and are consequently able to guarantee supplies of high-quality feldspars well into the future. One of these is the Kaltun Group, which has managed its large feldspar deposits parsimoniously for more than half a century so as to guarantee long-term product consistency and homogeneity. A typical example is the STD 01 Ex 10 standard feldspar, a historic product in the Kaltun range which has maintained constant values of chromophore elements and sodium over the years and will continue to do so in the future.

Kaltun Group’s production operations

Founded in 1960 by Mehmet Tuncer, Kaltun established itself right from the start as a pioneering supplier of raw minerals to the Turkish ceramic and glass industry. Over the years it has acquired numerous feldspar deposits, with reserves currently estimated at around 200 million tonnes down to a depth of 80 metres, equivalent to around 40% of total Turkish reserves.

6.2 million tonnes (Table 1). Di queste, circa 2.600.000 ton hanno avuto come destinazione l’Italia.

Si tratta sicuramente di un incremento imponente, determinato dalla forte e crescente domanda dell’industria ceramica locale e internazionale, indirizzata soprattutto verso materiali qualitativamente sempre più ricchi, ossia materiali con un più basso tenore di cromofori e di un alto contenuto in alcali.

A tale aumento dei consumi, una parte del settore minerario turco ha risposto con una non corretta gestione dei giacimenti, provocando un depauperamento delle riserve sia per quanto concerne la qualità dei materiali che, in misura minore, la quantità. Sul fronte quantitativo, l’eccessivo incremento dell’attività estrattiva (prevista in ulteriore crescita del 5% anche nel 2018) ha portato addirittura all’esaurimento e chiusura di numerosi giacimenti e di 11 aziende del comparto (Fig. 1). Sul fronte qualitativo, tale comportamento si traduce in una minore disponibilità di feldspati di massa o standard con significativi valori di cromofori e alcali. Rispetto al recente passato, oggi si estraggono e si selezionano materiali di qualità inferiore, che necessitano quindi di processi di arricchimento che, a loro volta, richiedono investimenti in nuovi impianti.

In questo scenario critico, si distinguono tuttavia aziende che hanno adottato strategie industriali più oculate e che sono quindi in grado di garantire un lungo futuro di forniture di feldspati di alta qualità.

Tra queste il Gruppo Kaltun, che ha saputo gestire i propri consintenti giacimenti di feldspati con parsimonia e capacità estrattiva e produttiva per oltre mezzo secolo garantendo sempre la stessa costanza e omogeneità di prodotti.

Un esempio è il feldspato standard STD 01 Ex 10, un prodotto storico della gamma Kaltun, che ha mantenuto negli anni valori costanti dei cromofori e del Sodio, e che continuerà a garantirli anche in futuro.

Le attività produttive del Gruppo Kaltun

Kaltun, fondata nel 1960 da Mehmet Tuncer, si è posta fin dall’inizio come pioniere per la fornitura di minerali preziosi all’industria turca della ceramica e del vetro. Negli anni ha accumulato numerosi giacimenti di feldspato, con riserve stimate oggi in circa 200 milioni di tonnellate fino a 80 metri di profondità, pari a circa il 40% delle riserve to
After overcoming the difficult years of the economic crisis, the Kaltun group is continuing to operate with satisfactory results under the leadership of current chairman Yuksel Tuncer. In 2017 sales volumes exceeded 2,150,000 tonnes, with exports standing at 34.37% of total Turkish exports. The group is made up of 15 companies, 9 of which are involved in the production and sale of industrial raw materials. It has more than 600 employees and is considered a world-leading company in the ceramics, glass, composites and coatings industry.

Today Kaltun has 22 production facilities:
• 8 grinding, drying and classification plants
• 3 flotation plants with an effective capacity of around 360,000 tonnes
• 5 crushing plants with a total capacity of more than 21,000 tonnes/day
• 1 wet magnetic separation plant
• 2 dry magnetic separation and enrichment plants
• 3 optical selectors.

It supplies a wide range of feldspars to the ceramic industry, including 60 different medium to high quality products, as well as premium materials such as FLT.300 Swarovski (Table 2), which is popular amongst Europe’s most prestigious glassware manufacturers.

Kaltun also invests continuously in plants, facilities and vehicles so as to provide the ceramic industry with a high-quality service and to continue to supply a product that meets its needs, while at the same time treating this material as a precious asset for the future.

<table>
<thead>
<tr>
<th>SiO₂</th>
<th>Al₂O₃</th>
<th>Fe₂O₃</th>
<th>TiO₂</th>
<th>CaO</th>
<th>MgO</th>
<th>Na₂O</th>
<th>K₂O</th>
<th>P₂O₅</th>
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<td>19.40</td>
<td>0.0050</td>
<td>0.02</td>
<td>0.36</td>
<td>0.03</td>
<td>11.26</td>
<td>0.10</td>
<td>0.00</td>
<td>0.10</td>
</tr>
</tbody>
</table>

TABLE 2 - CHEMICAL ANALYSIS OF FLT.300 SWAROVSKI FELDSPAR
Analisi chimica del feldspato FLT.300 Swarovski

Kaltun Mining feldspar quarry ~ Deposito di Feldspato di Kaltun Mining
Kaltun Mining milling plant ~ Impianto di macinazione Kaltun Mining
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