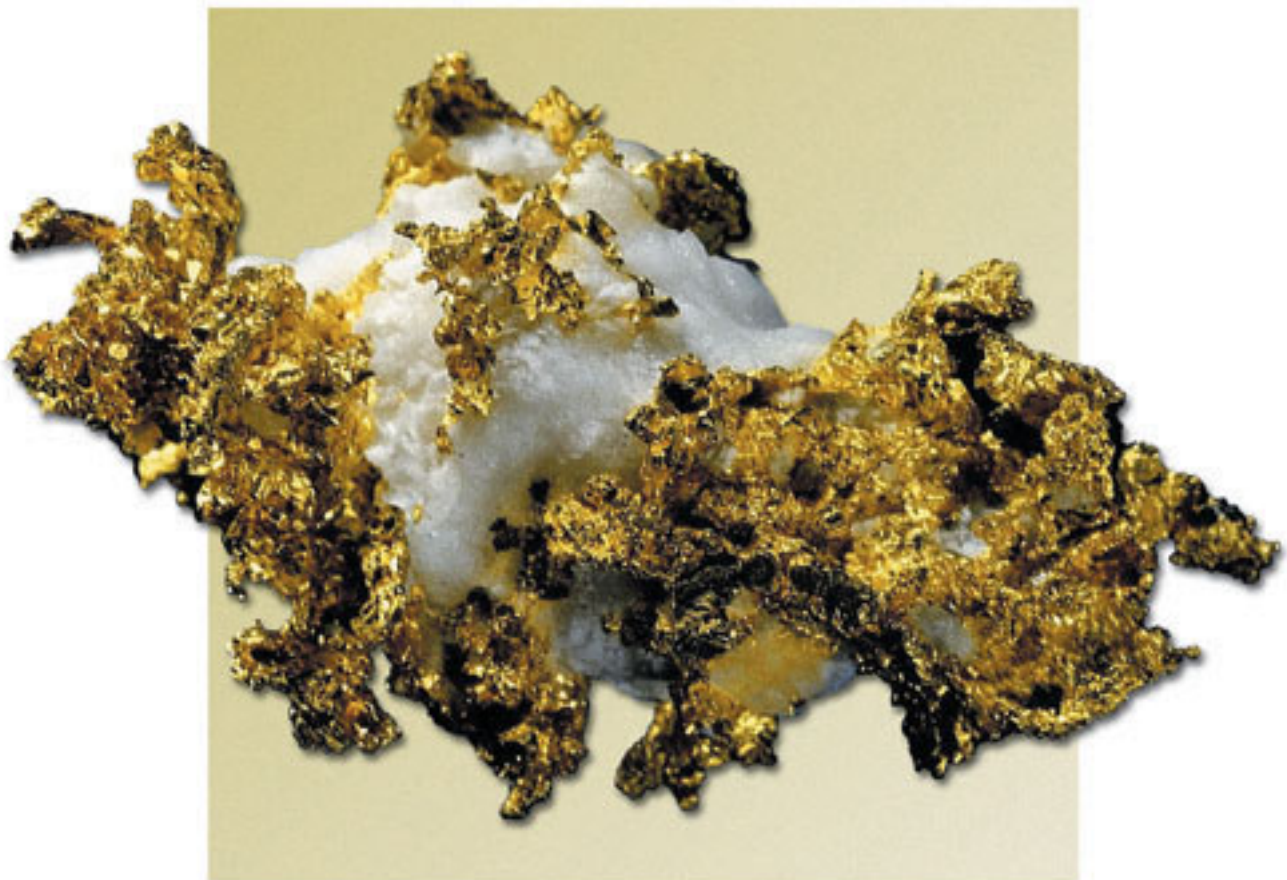
# GOLDEN PROSPECTS IN EUROPE



# The Long History of Gold

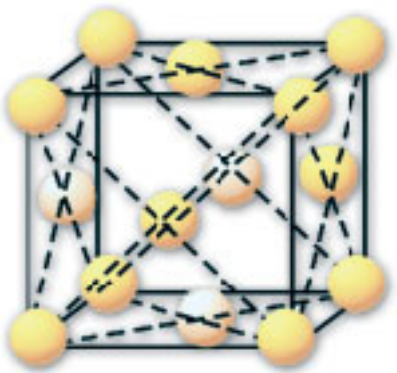
Throughout the history of humanity, gold has always exerted a sort of magical power on people, probably because of its extreme scarcity and its evident beauty. Man's first contact with the yellow metal most likely dates back to remote antiquity, even though we cannot pinpoint with precision the date and place. Many of the oldest and best-preserved golden antiquities- most of them used as adornment objects- originated in Egypt during the times of the Pharaohs. One of the most beautifully ornamented and preserved pieces is the tomb of King Tutankhamen, who died in 1352 BC. It represents what is undoubtedly one of the greatest treasures of the Egyptian goldsmiths' craft and already shows the magnificence of such work even in ancient times.

As a matter of interest gold inspired many other civilisations, and was quickly recommended above all other metals. It is also well-known that gold was first used for jewellery long before its use for monetary purposes. The first use of gold as money was claimed by the citizens of the Kingdom of Lydia (today's western Turkey), when King Croesus, created a coin emblazoned with his own image (from 560 BC). Since then the precious metal has been used by every civilized country as currency and has also become a symbol of wealth, power, and the basis of economic life.

Apart from the Egyptian Art, gold ornament collections were also found in the history of Incas, Aztecs, Chinese, Japanese and of course European civilizations. Precisely because of its rare properties gold rapidly provoked a real fever but also a cursed thirst all around the world. Virgil, the famous Roman poet of Antiquity described man's undying lust for gold when he wrote "Auri Sacra Fames" (the cursed thirst for gold).

However, it should be noted that gold was abandoned as a monetary standard in the 1930s when other investment objects, substitutes or alternatives appeared. But the famous metal still plays a significant role. Like ancient cultures, our modern society still recognizes its value and beauty. It continues to adorn us. Gold is not only present in jewellery, although this represents a great part of the gold market, it is also used in many other applications.

# The Properties of Gold



Gold atom

GOLD is one of the rarest elements on earth and is considered as the most precious of all precious metals. GOLD is beautiful, which makes us envious. GOLD is golden-yellow, which makes it naturally equate with the sun. GOLD has exceptional qualities, unlike other metals. GOLD is soft, very malleable, resistant to corrosion, almost completely indestructible and non-toxic, which are very useful properties if we look at the various applications it has. Indeed, it is said that its malleability properties allow it to be hammered into a sheet so thin that light can pass through it. So ductile that it can be drawn into thin wires kilometres long. So resistant that it doesn't react with water or oxygen. Its scarcity and its chemical and physical properties have made it one of the most prized of Earth's natural resources. It can be easily alloyed with other metals such as copper or silver, which widens the range of possible colour shades and increases the metals' hardness and abrasion resistance. GOLD is a metallic element and has as chemical symbol Au, which has its origin in the Latin word "Aurum", which means *Glowing Down.*

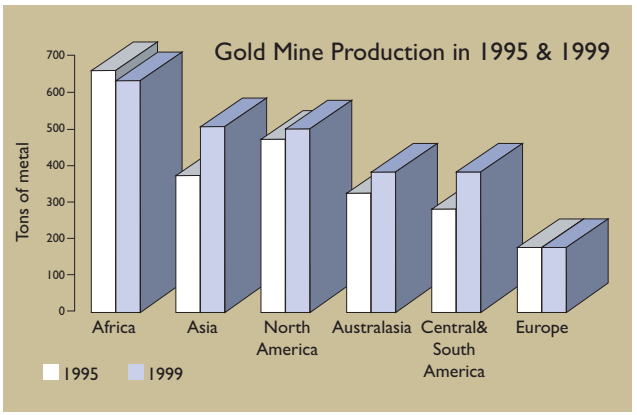
## Gold at a glance

| | |
|---|---|
| Colour | Golden-yellow |
| Weight | 19>Water; 2>Lead |
| Melting point | 1063°C |
| Boiling point | 2660°C |
| Atomic number | 79 |
| Gold group | Gold, Silver & Copper (same properties) |
| Measure | Carat (pure gold = 24 carats) |

# Gold Mining in Europe

## Key figures

It is estimated that only about 145,000 tonnes of gold have ever been mined in the world (end of 2001). Amazing if we compare it to the evolution of steel production for Europe only, where approximately 158.508 metric tons were produced in 2001, according to the European Confederation of Iron and Steel Industries. That's the reason why the noble metal is considered so scarce. Its supply is limited by nature itself.

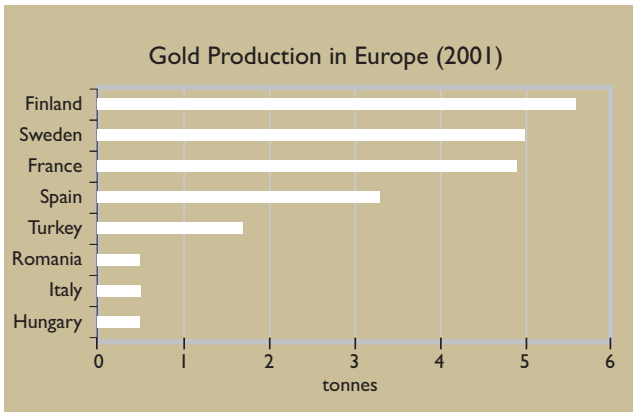



Source: Minerals Handbook 2000-2001, Phillip Crowson

World mine production was estimated at 2,576 tons for the year 1999, of which only 173 tons were extracted in Europe. The gold demand then represented about 65% of the total production. Amongst the main sources of demand the jewellery sector (which represents about 75% of the market), industry and investors are the most important other ones.

## Where Gold is found

South Africa has undoubtedly the largest gold reserves in the world. However, traces of mines yielding the precious metal dating from prehistoric times have been found in Europe, e.g. in Thrace and in other areas around the Aegean. These historical locations, which have extremely rich natural ores, will probably see the development of new mining sites shortly. Also Europe holds important gold deposits. Russia is




Source: Minerals Handbook 2000-2001, Phillip Crowson

the largest European gold producer, with some 152 tons mined in 2001, followed by Sweden (5 tons) and Spain (3.3 tons)[1] . Turkey has also become an area of focus for international mining companies. Turkey produced some 4.2 tons of

[1] Source: World Metal Statistics- January 2003

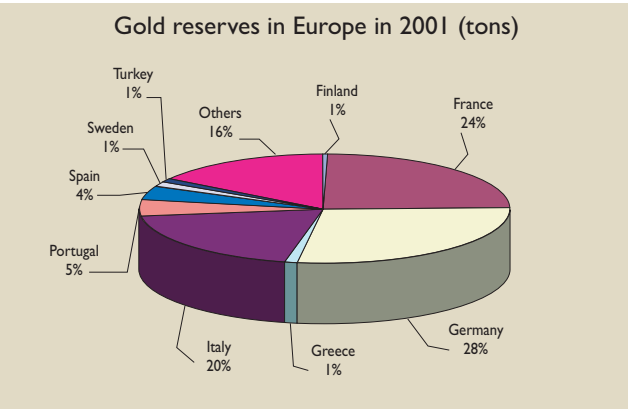
Examples:


Boliden
Sweden
Greece
Perama
Thracean Gold Mining
Sapes Thrace Minerals
Ovacik
Turkey
Villalba
Valle mine
Spain





gold in 2002 and 1.7 tons in 2001.




Source: Minerals Handbook 2000-2001, Phillip Crowson

The northern part of Europe, in particular Sweden and Finland, has shown to be an area with large potential for gold mining. The major mining companies in the world are actively involved in gold exploration in these countries, and new mines are near commissioning in Sweden and Finland.

## How gold is mined

As soon as it has been decided to explore a site for potential mining activities, a range of technical actions commence, which take into account various regulations, requirements and standards. If sufficiently high grades and amounts of gold are found in a deposit for it to be considered economically viable, mining activities can be permitted and then developed. Ore can be mined from both open pits and underground mine sites.

Four steps will be necessary to mine the ore: drilling, blasting, loading and hauling. Today's operations are highly mechanized and automated and are based on large, efficient, low-energy and reliable machine and transport systems. Generally, the first processing steps are crushing and grinding. Subsequent steps are depending on the nature of the ore. In many cases, the gold is associated to a copper mineral, which means the recovery takes place simultaneously with the recovery of copper, and the production of pure

gold takes place at the smelter. In many cases, gold can be recovered using gravity processes such as shaking tables. In the global perspective, however, most gold is recovered using cyanidation. Such processes have been used for more than one hundred years to improve the processing results and to eliminate the need for mercury

amalgamation. Cyanide is a substance which has the ability to extract gold and silver from ore at very low concentrations. The leaching process involves formation of complexes of gold and cyanide, and the use of activated carbon to bind the gold complexes. From the carbon then, the complexes can be extracted and the metal can be recovered, e.g. by application of a subsequent electrowinning process. Refractory gold – gold in a form not directly amenable for cyanidation - may require oxidation, e.g. bio oxidation, in order to liberate the gold and make it accessible to cyanidation.

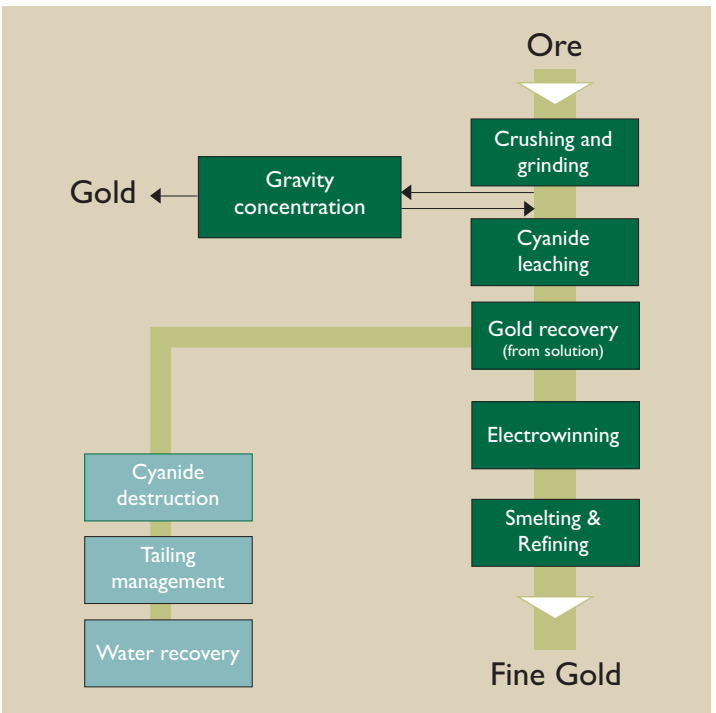
After finishing mining, the exhausted mine site will be rehabilitated and given back to nature for further uses such as a wildlife habitat, recreation or building. This practice is the standard used in Europe today. According to a reclamation plan put in place and depending on the properties of the mining waste, the waste deposits are

decommissioned either by covering with soil or equal material, or by inundation using water. The key parameter is then to avoid exposure of the pyrite content to air. After covering, vegetation is established, or measures to secure the water cover are put in place. The area is then adapted to the most appropriate post mining land use, which may vary from case to case.

## Cyanide in Gold Mining

Although discussions about gold recovery processes are often controversial, cyanide leaching is today considered to be the best available technology for the extraction of gold from ores, and has revolutionized gold mining in many areas of the world. Other chemicals have proven to leach gold and silver but were not successfully applied yet in large scale industrial processes on a worldwide basis. Therefore this industry is still seeking for a more efficient leaching process which fits all of today's needs and requirements specifically also from an environmental perspective. As cyanide is highly toxic it can have a detrimental impact on the environment and on living organisms in case of exposure if not handled properly, it is therefore necessary to

identify the risks related to its use and to implement measures and procedures to manage low risk operations. In order to prevent future incidents and improve the Environment and Health & Safety performance of all mines using cyanide throughout the world, the United Nations Environmental Program (UNEP) has developed, together with a large range of stakeholders (gold mining industry, governments, non-governmental organisations, labour, cyanide producers and financial institutions) the International Cyanide Management Code for the manufacture, transport, and use of cyanide in the production of gold in the mining industry. All EU gold mines today apply cyanide destruction technology and are currently in the process of adopting the code. A copy of the code can be downloaded from http://www.cyanidecode.org/thecode/thecode.PDF



# Gold recovery from non-gold mines and scrap recycling

Metals are material with excellent properties for recycling. Gold is, together with silver and the platinum group metals, considered as a precious metal. Precious metals can be directly extracted from the ore, but also from by-products obtained from the processing of other non-ferrous metals or from recycled material. Increasing production and use of electronic equipment in the modern society has made essential the development of new recycling technologies. Metal or scrap recycling will not only solve a part of the environmental problems, but will also give a second life to a certain percentage of precious metals. To recover valuable material such as metals, and to avoid accumulation of waste, extensive practices for recycling have been developed. Today, most of electronic scraps, and different types of wastes and residues are recycled or reused by environmental friendly technologies.

Pyrometallurgical and hydrometallurgical technologies are the main technologies that are generally used to recover metals from scrap. Umicore in Belgium, Nordeutsche Affinerie in Germany, Outokumpu in Finland, Boliden in Sweden are major European copper and lead recyclers and refineries with significant precious metal production. In December 2001 the European Commission adopted a Directive on ***Waste Electrical and Electronic Equipment and on the restriction of the use of certain hazardous substances in electrical and electronic equipment*** (COM (2000)347). This directive will have to be implemented by all EU Member States within 18 months of publication in the Official Journal. Consumers will be able to return used items such as televisions and toasters to the manufacturer free of charge, who will have to recycle at least 75% of the weight of every electronic/electrical product. It is expected that, as a consequence of this directive, gold recovery from recycling will further increase.

Source : " Possibility of Electronic Scrap Recycling in Slovakia "

# Application areas of gold

Gold has become a material of choice in many modern applications and plays a crucial role in the development of industrial and economic activity in Europe as well as in other parts of the world. Gold, like many other metals, has become an integral part of our everyday life but is not always recognized as such. Metals and metal compounds remain one of the basic material inputs for industrial production processes and everyday products. Despite newly developed synthetic materials, the application and consumption of metals have increased steadily over the decades and, in many cases, still increase today.

Gold is a vital material which ensures the reliability of many products ranging from dentistry to aircraft engines. From the earliest times when gold was mainly used in jewellery, gold's great virtues and exceptional properties have made possible a wide range of uses in many industrial areas such as electronics, medicine, space exploration, etc.

## Gold in Jewellery

Today, gold's main market is still the jewellery sector, which uses about two thousand tons of gold per annum. Unfortunately mass production methods have progressively surpassed traditional

manual craft skills, leaving a long tradition and venerated profession behind. To produce colour shades and improve the metal's resistance to wear gold alloys are used. From the deep yellow of pure, gold, colour shades ranging from green to purple can be produced by alloying.

## Gold in Dentistry

Gold in dental use is highly appreciated for its properties of non-oxidation, non-corrosion, non-toxicity, non-allergenicity and bio-compatibility. Gold has been used in this type of application for about 2700 years and gold's usage is still widespread in modern dentistry. Gold is used for inlays, crowns and bridges and is usually utilized as an alloy with other precious metals. The quantity used will depend on the application and gold is never harmful for human safety. Japan remains the leading dental gold fabricator, followed by Germany and the United States. However, demand in this area is declining, with gold being substituted by cheaper non-gold alloys and ceramics.

## Gold in Medicine

The fantastic virtues of gold inspired ancient generations in their medical reflections. Our ancestors believed that gold had healing powers. In modern times the magic metal is at the heart of scientific and medical research. For the same biological reason for which gold was used in dentistry, its use seems to be appropriate for a large number of other direct medical applications. Gold compounds have already proven their efficiency in some cancer treatments as well as in the treatment of arthritis, rheumatism and inflammations. Other medical applications include gold wires for pacemakers, implants, patches, ampoules, etc.

## Gold in Electronics

The second place in gold applications is taken by electronics, for which some 150 tons are use each year. Gold is an excellent conductor of electricity and heat reflector. It is therefore widely used in electronics and telecommunications, and is present in everyday objects such as pocket calculators, mobile phones, or computers and in more complex equipment like space machinery, aircrafts and missiles. The most significant uses of gold in electronics include[1] :

- Gold base finishes on contacts and connectors
- Gold bonding wires in semiconductor devices
- Thick and thin film gold plate applications
- Sputtered gold metallization
- Gold based solder alloy
- Solderable gold based coatings for printedcircuit boards

[1]Source : http://www.gold.org

# Environmental, Health and Safety aspects of gold mining

## Health & Safety aspects

Health & Safety Management is an integral part of any risk-related business today and should be considered a prime responsibility of every individual concerned.

Health & Safety issues should have a high priority, especially when they concern mining and mineral processing. Therefore the industry relies on a skilled and well educated work force. In particular, in operations where cyanide or other heavy metals such as mercury or arsenic are used, special attention is given to chemicals management. The operators are regularly trained in proper handling practices, equipment, first aid and emergency response procedures.

At sites where appropriate management standards are practiced, the transport, storage, preparation, use and destruction of chemicals is strictly controlled and monitored by the operating mining company. In addition, the supplier checks that the mining company has the competence and know-how to safely manage the substances, and should continuously provide up-to-date training packages for the operators, information material and 24 hours/day emergency response support.

## Environment aspects

Mining operations focus on minimising any environmental effects in the short, medium and long-term. This means that sites are designed not only to have the minimum impact during operation, but also the closure and after-care of the site is planned. Among the strategic tools to minimise any environmental effects we find the Environmental Impact Assessments (EIA), Risk Assessment techniques, monitoring and follow-up as routinely applied procedures. Environmental audits are regularly conducted to review and improve the environmental management at each site.

Cyanide leaching and the chemical management of cyanide are controlled by specific safety measures to prevent incidents and environmental impacts. The design of a cyanide leaching plant includes a thorough risk assessment where technical solutions aimed at the prevention of accidents and environmental impacts are identified.

The following features are often included in the design to prevent any impact on the environment and on the Health & Safety of operators:

- The incorporation of a cyanide destruction circuit before the tailings are disposed into the tailings pond.
- Secondary containment of leach-tanks to collect any accidental spillages .

- **Leach-tanks placed outdoors are open. Indoor equipment is connected to a gas extraction system with a scrubber operating with NaOH- solution.**
- **Backup power generators are installed.**
- **Any spills are pumped back to the circuit.**
- **Well educated and trained operators run the operation.**
- **Strict environmental monitoring of the entire site is applied.**
- **Strict Health & Safety routines.**
- **Strict management procedures for leachate.**
- **Strict management of chemicals.**

At all sites in Europe where tank leaching is practised, the effluent (tailings and tailings water) undergoes cyanide destruction prior to discharge into the tailings pond. The treatment results are very satisfactory. Nevertheless, the water quality in the tailings pond is frequently monitored and

analysed for cyanide concentration as well as other components such as heavy metals, pH and conductivity.
The physical stability of the tailings pond is guaranteed using conservative design, careful quality control during construction, proper management during operation, monitoring and control, dam safety audits and a proper closure at the end of its operational period.

**European obligations**

At the moment the European Union is developing specific mine waste legislation, which will include limit values for cyanide, as well as a Best Available Technology document (BAT), which will provide recommendations for legislators and industry in handling cyanide. The industry is fully supportive of these two initiatives.
Europe represents a modern and developed society, with technology and wealth to a large extent relying on the benefits of metals, including gold. Europe today, even as a net importer, has a significant production capacity for gold, and for the future, very promising resources of the metal. European mines operate at world class standard with respect to sustainability criteria, i.e. environmental protection, economical performance and social development. Therefore, it is Euromines' opinion, that Europe has a responsibility to, as much as reasonably possible, support it's demand for gold and other metals by supporting the mineral industry to operate its mineral resources according to the highest available standards.

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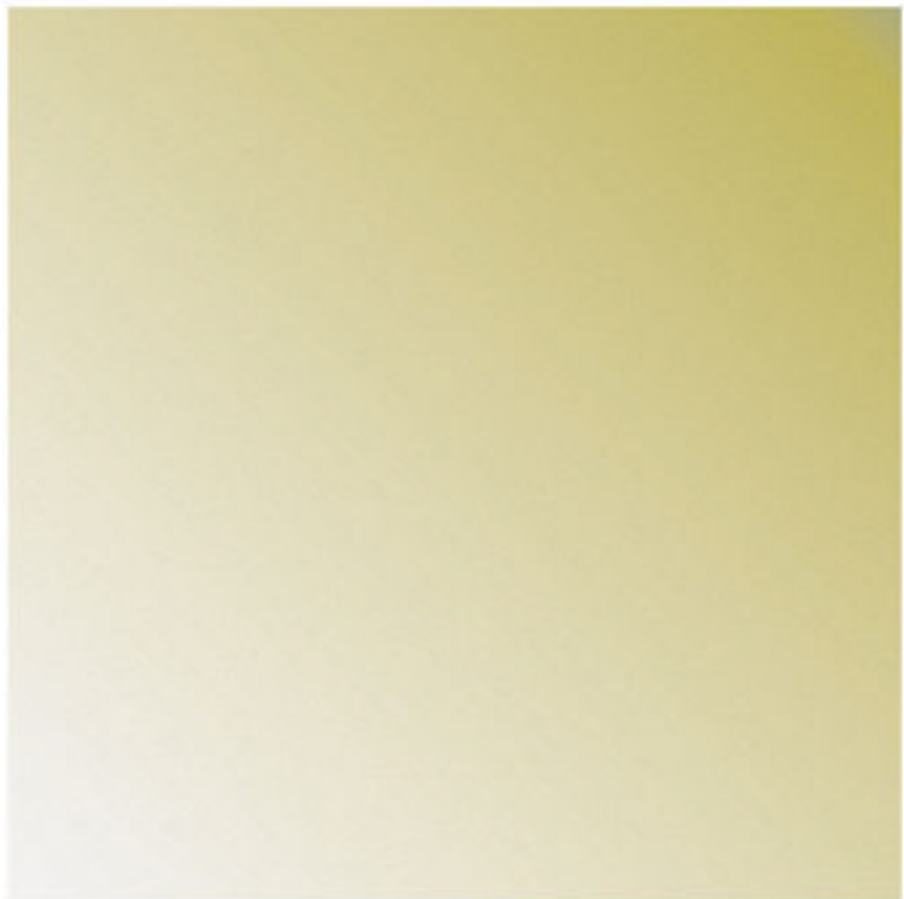

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