

PERLITE

*By Brian Coope
Industrial Minerals Consultant*

Between 1990 and 2000 the world perlite market grew from 1.7 Mt to 2.7 Mt/y. North America and Western Europe continue to be the main consuming regions although strong growth is being experienced elsewhere and in Asia in particular. The main growth applications are in acoustic ceiling tiles (as lightweight, fireproof insulating aggregate) and in horticulture (as a porous growing medium).

Perlite is a glassy volcanic rock containing on average around 73% silica and 13% alumina and 2-5% of combined water. When crushed and graded perlite is introduced into a furnace at a temperature close to the fusion point the contained water is converted to steam and the grains swell into light, cellular particles that are usually white in colour. Expansion usually takes place in a vertical kiln at temperatures in the 800-1100°C range and a volume increase of up to 20 times is common – and can be exceeded in high-grade perlites.

Expanded perlite has excellent thermal and sound insulation properties and is widely used in construction as aggregate in insulation board, plaster, concrete, and as loose fill insulation in cavity walls. Other insulation uses include cryogenics where it is used in lining tanks for gases held at low temperature. It is also used in filtration (as filter media), in horticulture (as soil conditioner and rooting medium), and as a filler in paints, plastics, and other products.

World production of perlite was estimated to be of the order of 2.7 Mt in 2000 and the leading producers were the US, Greece, China, Turkey and Japan whose combined output accounted for over 85% of world total.

World production and supply is dominated by three companies – Silver & Baryte Ores

Mining (S&B), Grefco, and World Minerals. Through their network of subsidiaries and associates, they account for approximately 60% of world raw perlite output. S&B alone accounts for around 30% of world raw perlite output.

Silver & Baryte (S&B) is a Greek company, quoted on the Athens Stock Exchange. In recent years it has grown through expansion and acquisition to become a major industrial minerals group and a world leader in perlite and bentonite (but not in either silver or barytes ironically). The company's operating base is the island of Milos in the Aegean where S&B is now the sole operator of Europe's most important perlite and bentonite resource. Greece's perlite exports in recent years have been of the order of 500,000 t/y, principally to Western Europe (60%), the US (30%), and the Middle East (10%).

During the past five years the company has acquired perlite mining and processing operations in Turkey (Pabalk and Saba at Biga, 1995), Italy (Sarda Perlite in Sardinia,

World Perlite Production ('000 t)			
	1998	1999	2000
US	685	711	675
Greece	658	600	625
China	400	450	500
Turkey	250	250	250
Japan	250	260	260
Hungary	130	141	140
Slovakia	50	50	50
Mexico	55	55	55
Philippines	20	20	20
Italy	65	65	65
Armenia	10	40	40
Others	30	30	30
Total	2,603	2,672	2,710

Source: Author's estimates

1996), Greece (Otavi in Milos, 1998), and has entered a joint venture in China (Xinyang in Henan province, 1998). The company is the dominant supplier to European markets but also plays a significant role in North American markets too, through its subsidiary, Eastern Industrial Minerals, which handles sales of Milos perlite in the US. US imports from Greece were of the order of 150,000 t in 2000. S&B is predominantly a supplier of raw (crushed and graded) perlite and its current involvement in perlite expansion and downstream products is modest.

The US

Grefco and World Minerals are both US companies and have their domestic operations based on the classic deposits at No Agua, New Mexico. Both are also highly active in the production and sales of expanded perlite and downstream products. In particular these two companies dominate the world's perlite filter aid market.

Grefco's No Agua mine and plant and a second mine/plant unit at Socorro, New Mexico, are operated by a subsidiary, Dicaperl. The company also has raw perlite operations at Oriental in Puebla state in Mexico (Mineral Oriental) and at Aragats in Armenia (Aragats Perlite). In the US Grefco is also highly active in expanded perlite production through the activities of Dicalite (specialising in perlite filter aids) and Chemrock (specialising in insulation and construction products). The company also has a major expanded perlite operation at Ghent in Belgium which is supplied by a combination of Turkish and Armenian raw perlite.

World Minerals is part of Allegheny Corp. and conducts its perlite mining and processing activities through its Harborlite subsidiary. In addition to its 350,000 t/y facility at No Agua the company also operates perlite mine/plant units at Superior, Arizona, and at Diklili in the Bergama area of Turkey. Harborlite is also very active in the market for expanded perlite products (including filter aids) and operates

expansion plants in France, the UK, Spain and Italy.

Other established US perlite mining companies include Eagle-Picher Minerals in Nevada; American Perlite Co. in California; Wilkins Mining & Trucking and USF Corp. in New Mexico. Some of the newer perlite producers have been beset by problems in recent years but appear to be turning the corner and making some impact in the market; these include Cornerstone Industrial Minerals in Oregon (now owned by Seven Peaks Mining), Idaho Minerals in Idaho (now part-owned by the Hess Pumice group), and Basin Perlite (formerly Pearl Queen) in Utah.

In Eastern Europe the main producer is Hungary through the operations Perlit 92 at Palhaza. Until recently the company has operated as a subsidiary of the Irish company, Navan Resources, but was acquired in 1999 by a major domestic consumer, Duna-Drava Cement. The company exported around 40,000 t to Germany and Austria in 1999.

In Turkey there are five main producers of raw perlite and the two largest - Pabalk/Saba and Harborlite Aegean - are part of the S&B and World Minerals empires. These two companies account for the bulk of Turkey's exports, which are currently in the region of 180,000 t/y (150,000 t/y to Western Europe). The remaining three producers of raw perlite - Perlitas, Persa, and Eti Holding (formerly Etibank) now concentrate mainly on domestic and regional markets.

US Expanded perlite Consumption by Application (Mt)	
	1999
Concrete and plaster aggregate	18,000
Fillers	52,600
Filter aids	60,000
Formed products	499,000
Horticultural	70,700
Insulation	13,700
Other	17,300
Total	729,000

Japan's industry is dominated by production from Mitsui Mining & Smelting in Kushiro and Kitakata; Ube Kosan in Yamaguchi prefecture; and Asano Perlite (now part of Taiheiyo Cement) in Chiba. Production has been in the 250,000/300,000 t/y range for most of the 1990s and virtually all production has been for domestic consumption.

The Expanded Perlite Market

Both Harborlite and Grefco are also major producers of expanded perlite and downstream products. Until now S&B has been less active in expanded perlite but its recent takeover of Otavi involves major expanded perlite assets in Germany as well as raw perlite operations in Greece. A large number of companies operate in the expanded perlite sector but the largest by far in volume terms is Armstrong, a major producer of acoustic ceiling tiles, that accounts for 33% of US raw perlite consumption and 20% in Western Europe. Other important expanded perlite producers include Silbrico, USG, GAF, Permalite, and Celotex in the US; CECA, Deutsche Perlit (Knauf), Otavi, Tilcon, BPB, Pull, and Peletico in Europe; and Mitsui Mining and Tokyo Perlite in Japan

Perlite Prices

Perlite prices tend to remain fairly stable. During the past five years, the average ex-works value of perlite in the US has been around US\$30/t for raw perlite and US\$140-400/t for expanded perlite (from tile grades to cryogenic grades). In Europe fob prices for crushed and graded raw perlite have ranged from around US\$25/t for fines (ie tile grade) to

Expanded Perlite Prices (US\$)		
US average ex-works values	1998	1999
Tile grades (captive values)	146	146
Plaster aggregate	330	177
Concrete aggregate	310	284
Filter aid	317	319
Horticultural aggregate	309	326
Cavity fill insulation (silicone treated)	373	373
Cryogenics	397	386

Source: USGS

US\$50/t or more for coarse grades during the same period. Expanded perlite aggregate ex-works prices for construction, insulation, and horticultural applications have been in the US\$300-450/t range.

Similarly the prices published on a regular basis in *Industrial Minerals* magazine have been virtually unchanged over the past five years, as follows:

Outlook

The use of perlite in building and construction concerns such applications as an ultra-lightweight aggregate in plaster and concrete, loose-fill insulation, and as a prime ingredient in insulating board and ceiling tiles. Some of these markets - particularly insulating board and ceiling tiles - have shown exceptional growth in recent years whereas the others can only be described as low growth markets.

The other main industrial usage of perlite is in filter aids, where it is used for water treatment and purification, beer and wine clarification, and the processing of sugar and sweeteners; oils and fats; and chemicals and pharmaceuticals. Such markets are also well established in North America and Western Europe but still offer useful growth elsewhere. However, the most promising area for growth is in horticulture, where expanded perlite is finding increasing usage as a substrate for greenhouse crops and in fine form as a peat replacement.

Table 3 - Industrial Minerals quotations May 2001

	UK£/t	US\$/t
Raw crushed and graded in bulk, cif UK	55-60	91-99
Aggregate, expanded, ex-works UK	210-300	347-495
Filter aids, expanded, milled, del UK	312-335	515-553
ex-plant US		210-422