

Hard Rock Lithium Ore Types & Mineral Characteristics Guide

Spodumene, Lepidolite and Petalite Comparison
for Lithium Processing Applications



SPODUMENE



LEPIDOLITE



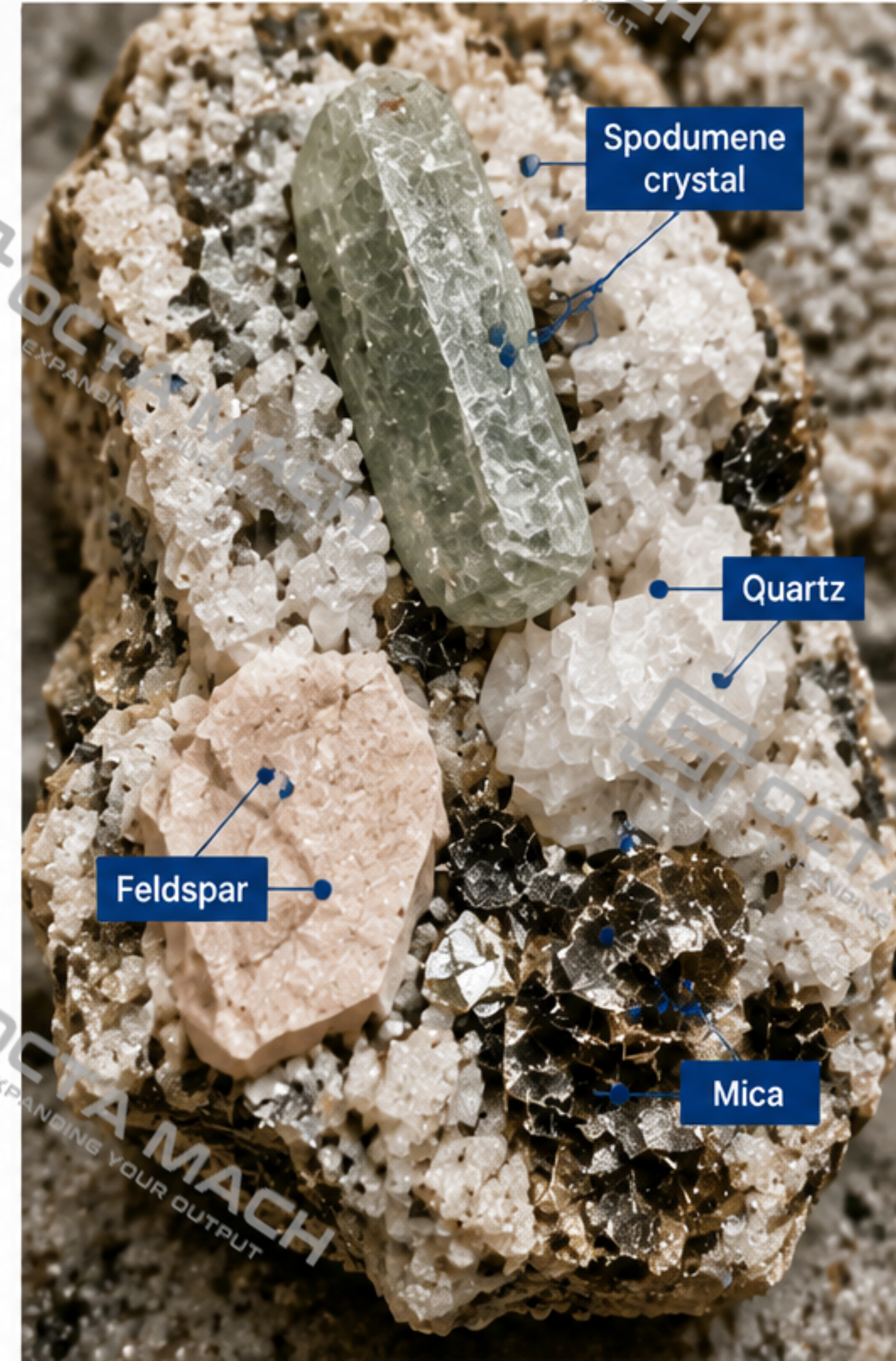
PETALITE



Lithium resources occur mainly in brine, clay and hard rock deposits. Hard rock lithium deposits require physical processing because lithium minerals are hosted within pegmatite rocks.



RESOURCE TYPE	MAIN CHARACTERISTICS	PROCESSING ROUTE
 Brine Lithium	Lithium dissolved in saltwater	Evaporation and extraction
 Clay Lithium	Lithium hosted in clay minerals	Specialized extraction
 Hard Rock Lithium	Lithium minerals in pegmatite rocks	Crushing, grinding and beneficiation



PEGMATITE CHARACTERISTICS

Pegmatite is a coarse-grained igneous rock that commonly hosts lithium minerals such as spodumene, quartz, feldspar and mica.

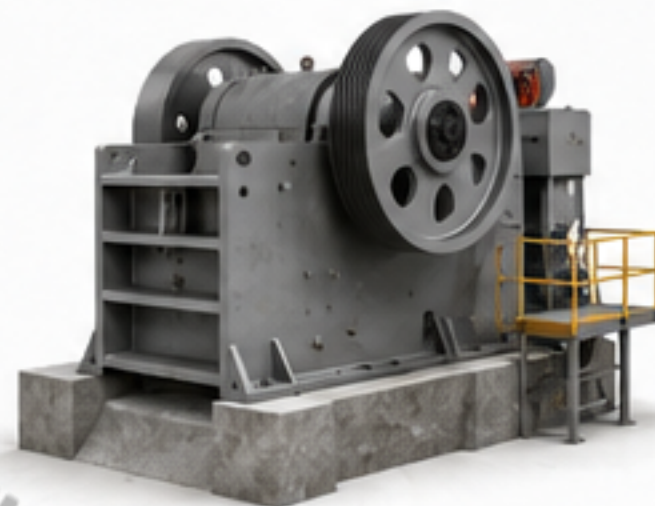


	Chemical Formula:	$\text{LiAlSi}_2\text{O}_6$
	Mineral Group:	Pyroxene
	Mohs Hardness:	6.5–7
	Occurrence:	Pegmatite deposits
	Associated Minerals:	Quartz, Feldspar, Mica

ROM Pegmatite



Crushing



Grinding



Beneficiation



4 Lepidolite and Petalite Characteristics

Lepidolite



Lithium mica



Layered silicate structure



Chemical composition: $\text{K}(\text{Li},\text{Al})_3(\text{Si},\text{Al})_4\text{O}_{10}(\text{F},\text{OH})_2$

Petalite



Lithium silicate



Framework structure



Chemical formula: $\text{LiAlSi}_4\text{O}_{10}$



Processing consideration

Different mineral structures require different beneficiation evaluation.

5 Spodumene vs Lepidolite vs Petalite

The three main lithium-bearing minerals in hard rock deposits have distinct structures and respond differently during processing and beneficiation.

SPODUMENE



Chemical Formula

$\text{LiAlSi}_2\text{O}_6$



Mineral Group

Pyroxene



Crystal Structure

Chain silicate structure



Processing Behavior

Relatively hard and tough; requires crushing and grinding for liberation.

LEPIDOLITE



Chemical Composition

$\text{K}(\text{Li},\text{Al})_3(\text{Si},\text{Al})_4\text{O}_{10}(\text{F},\text{OH})_2$



Mineral Group

Lithium mica



Crystal Structure

Layered silicate structure



Processing Behavior

Soft and flaky; prone to slimes generation, requires careful grinding and separation.

PETALITE



Chemical Formula

$\text{LiAlSi}_4\text{O}_{10}$



Mineral Group

Lithium silicate



Crystal Structure

Framework silicate structure



Processing Behavior

Hard but brittle; requires fine grinding for adequate liberation.

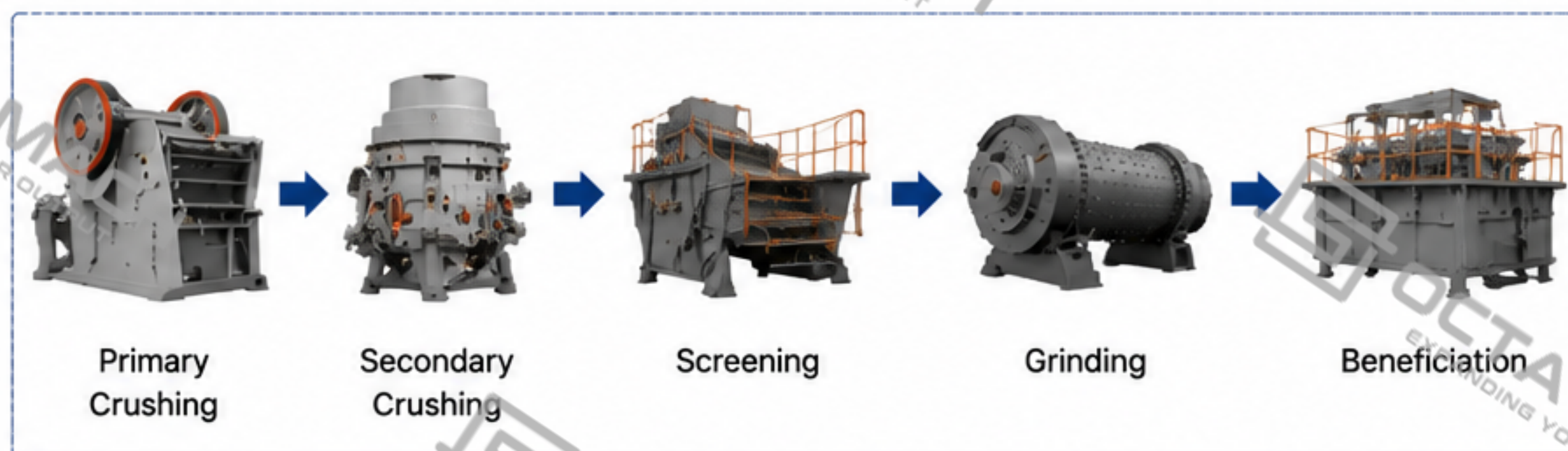
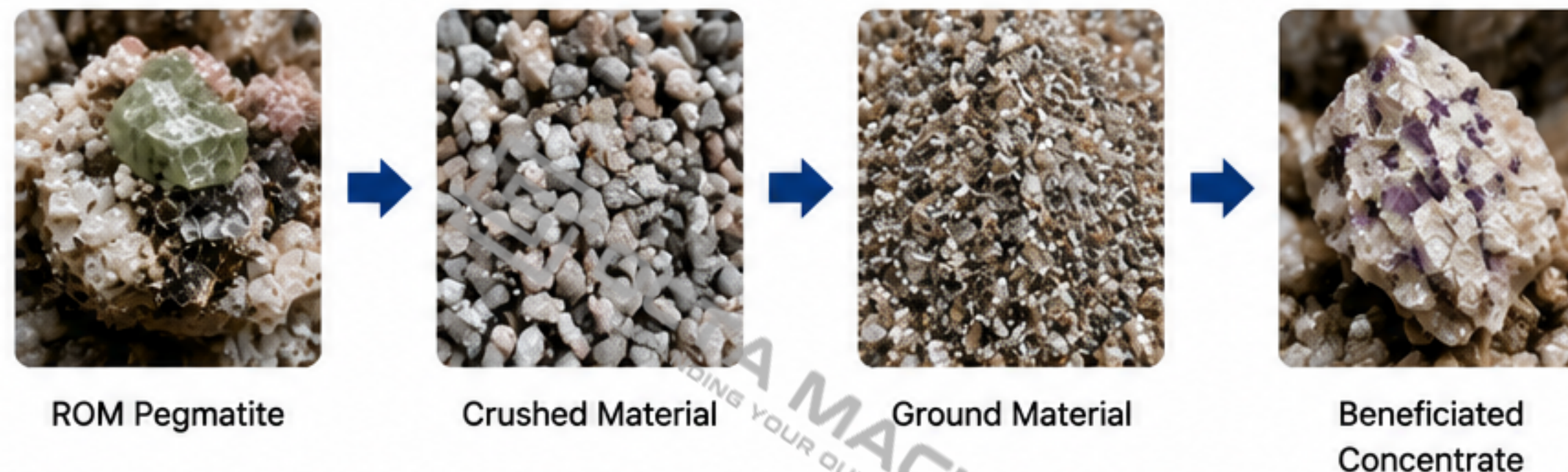
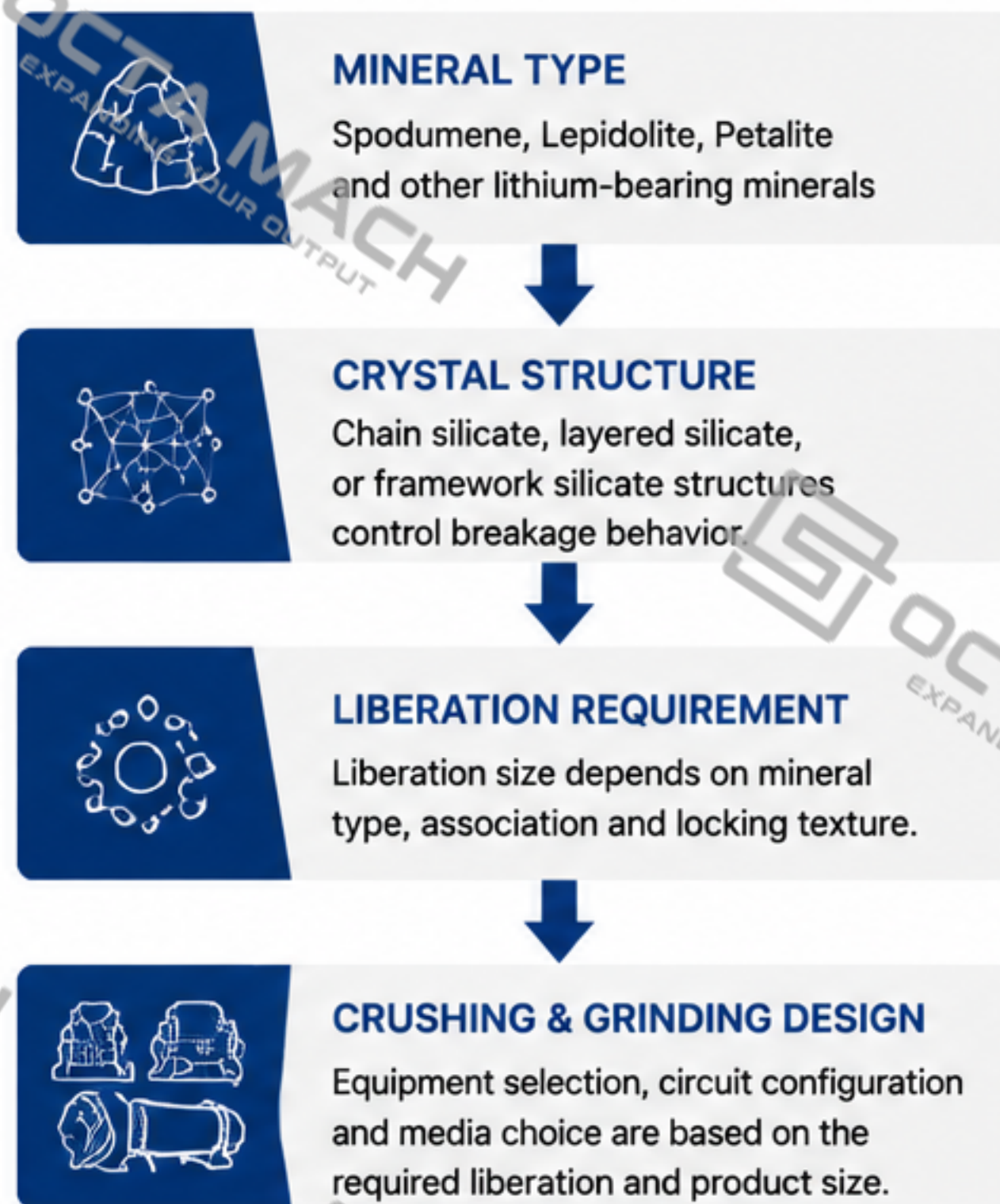


ENGINEERING CONSIDERATION

Mineral structure, hardness and liberation characteristics directly influence crushing, grinding and beneficiation circuit design.

6 Mineral Characteristics Affect Processing

The physical and mineralogical properties of lithium-bearing minerals determine the level of liberation required and directly influence the crushing and grinding circuit design.



KEY FACTORS INFLUENCING CIRCUIT DESIGN



HARDNESS

Higher hardness increases energy consumption and equipment wear.



MINERAL ASSOCIATION

Complex associations require finer grinding to achieve effective liberation.



PARTICLE SIZE REQUIREMENT

Target product size determines grinding level and classification strategy.