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Gravity Recovery of Fine Particles

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Andrew Gillis
Sepro Mineral Systems
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Outline

- Introduction
 - Common Gravity Applications
 - Why Choose Gravity?
- Gravity Technology
 - Falcon Semi-Batch Concentrator
 - Falcon Continuous Concentrator
 - Falcon Ultra-Fine Concentrator
- Complementary Processes
- Summary

Introduction



- What is Gravity Concentration?
 - Process in which particles of mixed sizes, shapes and specific gravities are separated from each other in a fluid by gravitational or centrifugal force.
 - Designed to separate based on specific gravity but actually separates on particle mass/inertia which depends on particle size and shape.

Gravity Concentration Applications

- Stating the Obvious
 - High SG particles (liberated)
- Primary Recovery
 - Minerals of **Au, Ag, PGMs, Ta, Sn, W, Cr, Co, Fe, Coal**, etc.
- Preconcentration
 - Gold sulphides
 - Minerals subject to expensive final processes
- Scavenging
 - Fine or friable minerals
 - Small deslime streams in large plants



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Why Choose Gravity Concentration for Fine Particles?

- High G-force can overcome challenges related to fine particle recovery
- Lots of surface area
 - High reagent consumption
 - Surface coatings inhibit chemical interaction
- Narrower size distribution
 - Particles are similar sizes
 - Higher liberation (hopefully)



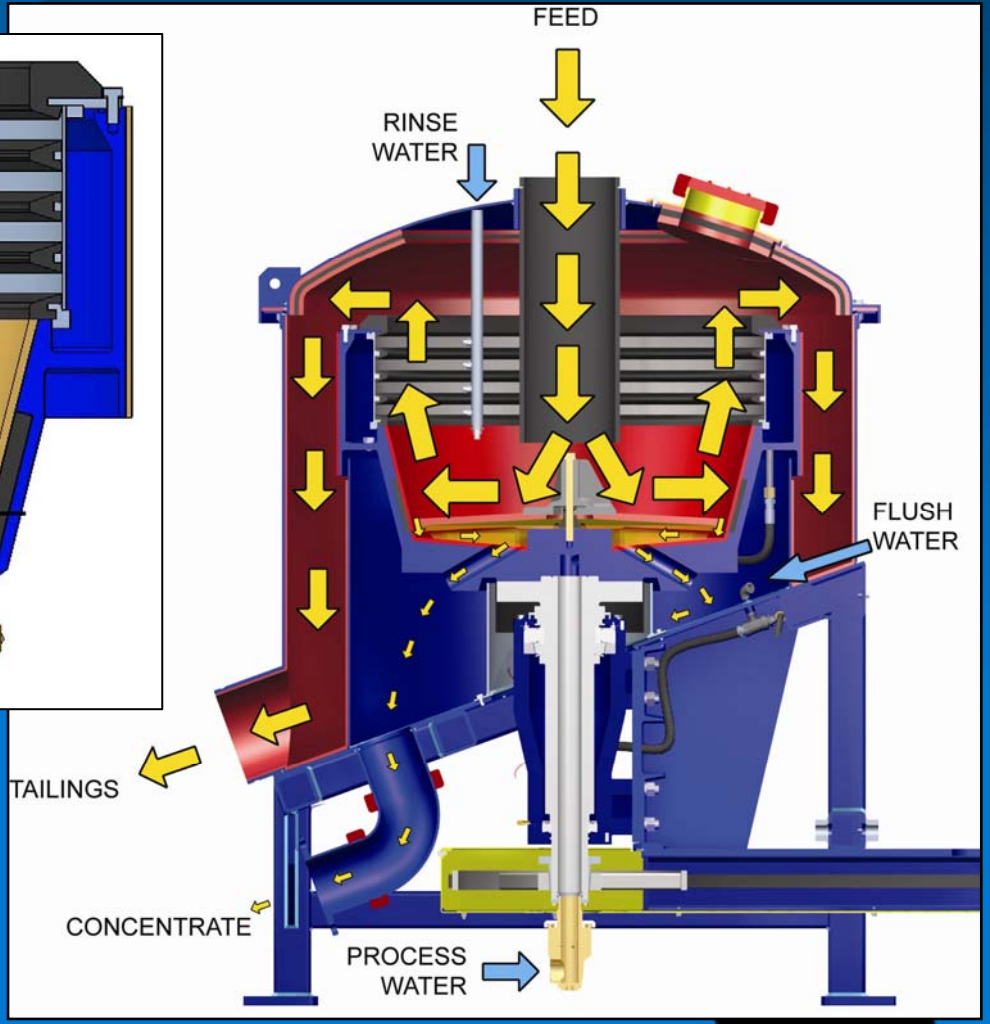
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Gravity Technology: Semi-Batch Centrifugal Concentrators

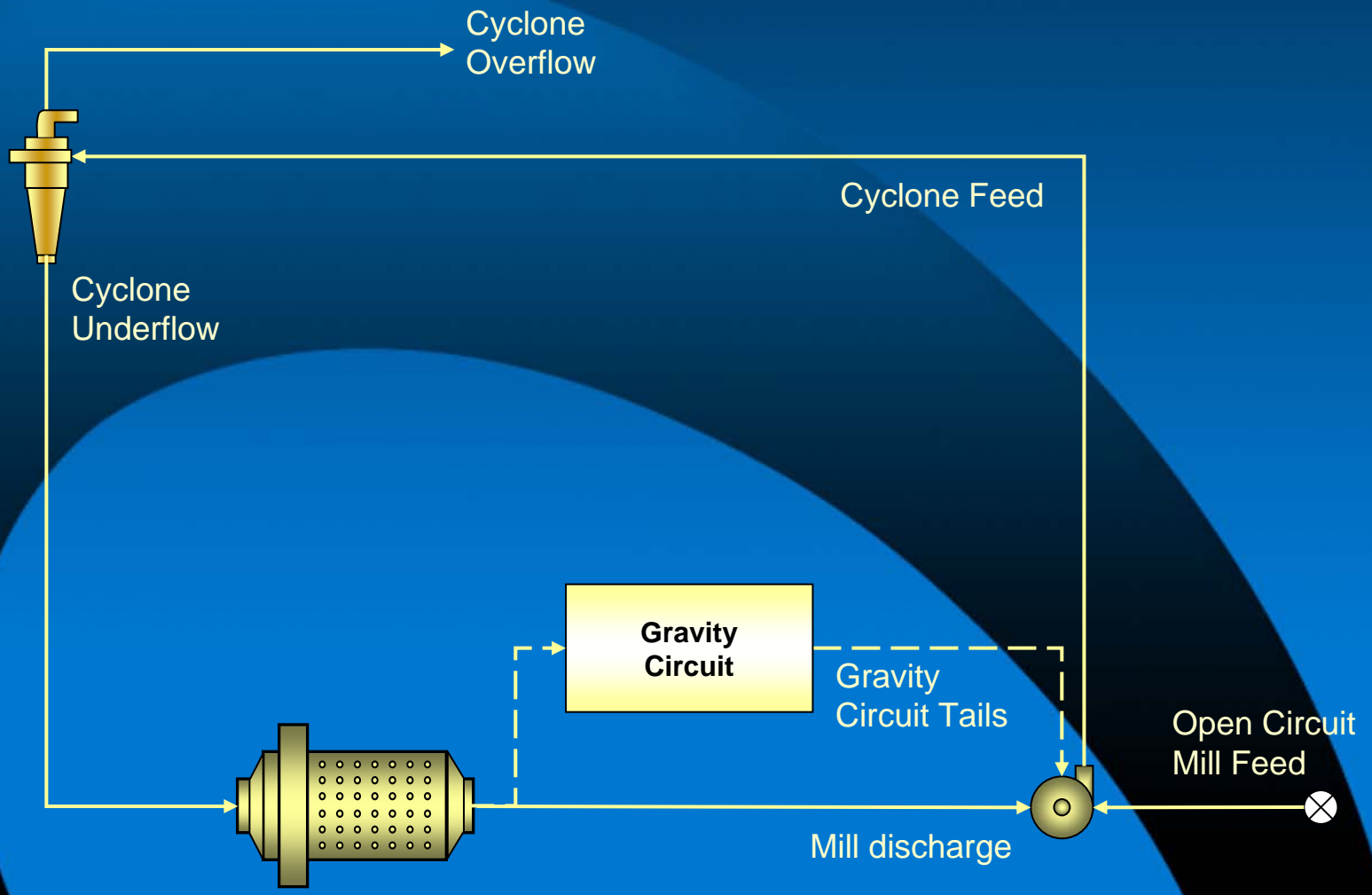


- Used for primary recovery of coarse to fine Au
- Typically used in milling circuits – best performance in cyclone feed
- Also used for alluvial gold recovery
- High G-force (up to 200 G's) enables fine particle recovery below 15 microns

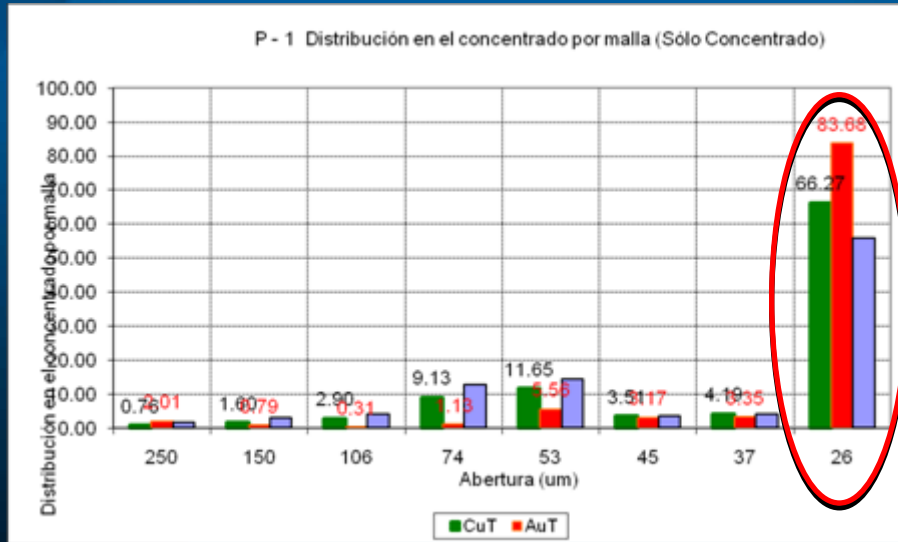
Gravity Technology: Semi-Batch Centrifugal Concentrators



Gravity Circuit Arrangement



South American Cu-Au Flotation Plant



> 80% of Au in concentrate is -37 microns

- Testwork conducted on cyclone Feed, O/F and U/F
- Cyclone O/F stream selected due to extremely fine gold
- Average (overall) recovery increase of 5%
- Increasing G-force from 75 to 120G's increased recovery by 48%



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Gravity Technology: Continuous Centrifugal Concentrators



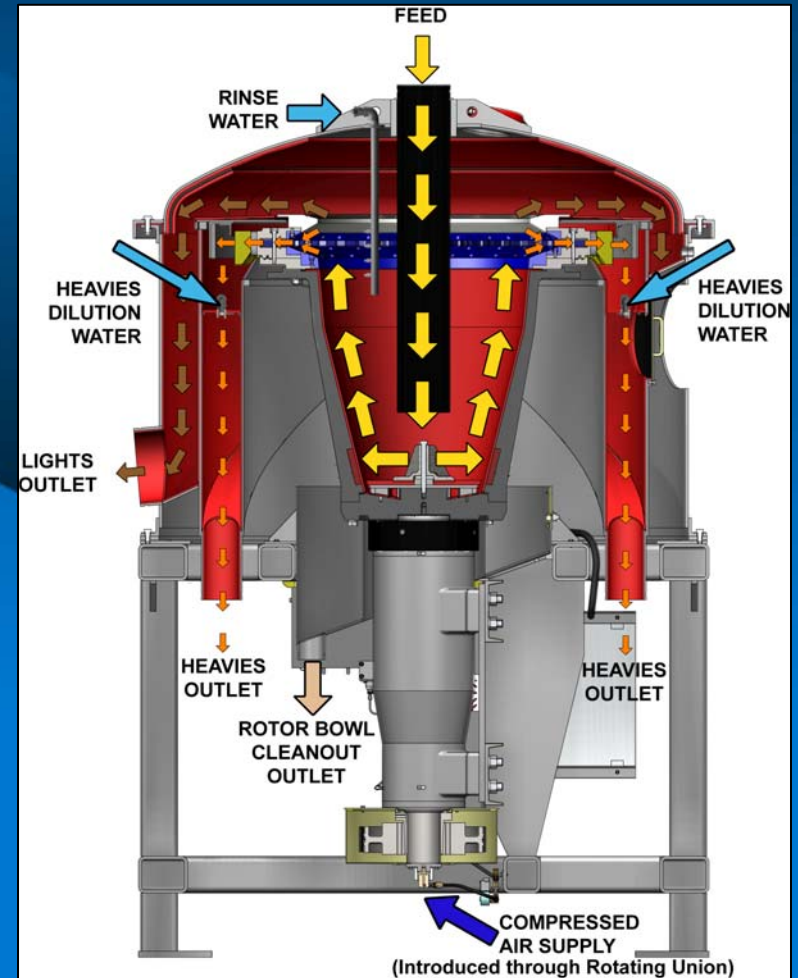
- High unit capacities relative to other gravity devices
- High G-force (up to 300 G's) enables fine particle recovery
- Good for preconcentration of fine particles
- Typically combined with other gravity technology in primary upgrade and scavenging applications

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Gravity Technology: Continuous Centrifugal Concentrators

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Precious Metal Preconcentration



- Sekisovskoye, Kazakhstan
 - Gravity preconcentration
 - Concentrate reports to first leach tank
 - Tailings report to second leach tank
 - Overall recovery increase of 5% and reduced cost by targeting leach effort

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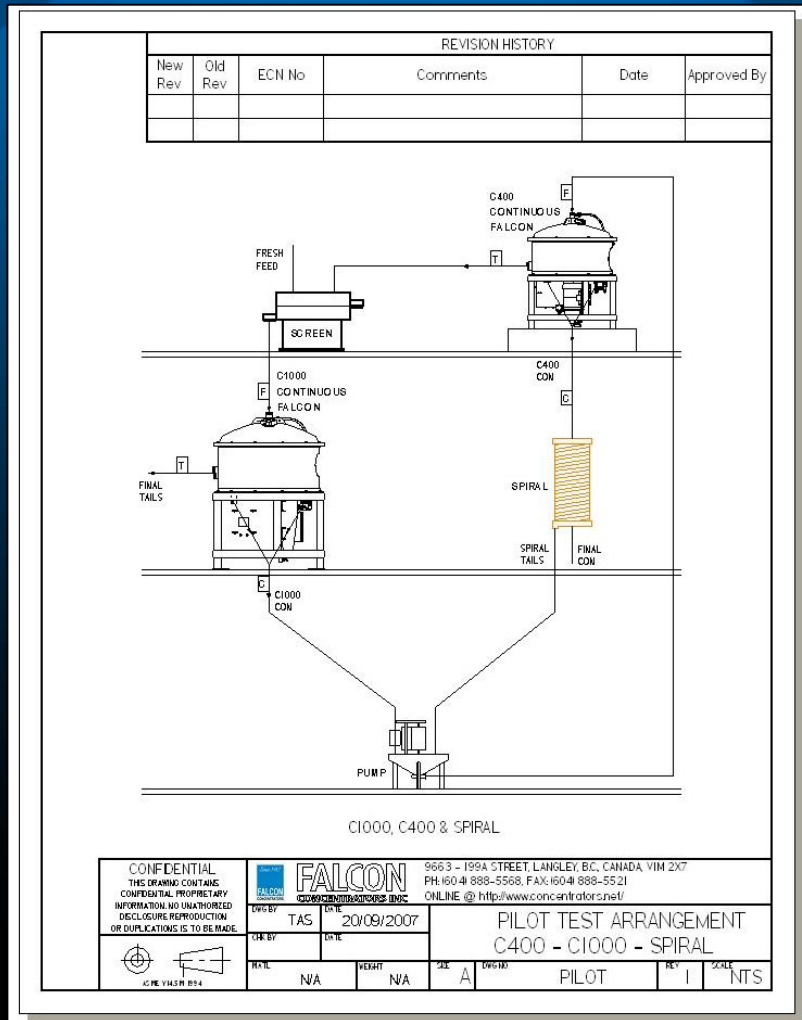
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Fine Iron Ore Scavenging



- Primary process is LIMS for magnetite, WHIMS and spirals for hematite
- Coarse (+300 micron) and fine (-300 micron) spiral circuits
- Fine spiral tails go to final tailings
 - $P_{80} = 60$ microns
 - Most rejected Fe is -75 microns

Fine Iron Ore Scavenging



- Feed grade ~10% Fe
- Falcon C400 used to clean fine spiral tailings
- Same spiral used to clean Falcon concentrate

Fine Iron Ore Scavenging



Test #	1	51	2	52	3	53
Falcon Feed	9.56	9.83	9.81	10.11	10.99	9.14
Falcon Con	19.19	28.82	19.39	19.70	30.22	27.41
Falcon Recovery	50.10	23.57	58.20	44.85	22.20	30.42
Spiral Con	63.10	54.31	65.01	60.61	63.23	64.40
Spiral Recovery	41.09	62.48	20.75	37.04	29.88	46.54
Overall Recovery	20.57	14.73	12.08	16.61	6.64	14.16



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Ultra-Fine Gravity Technology: High-G Centrifugal Concentrators

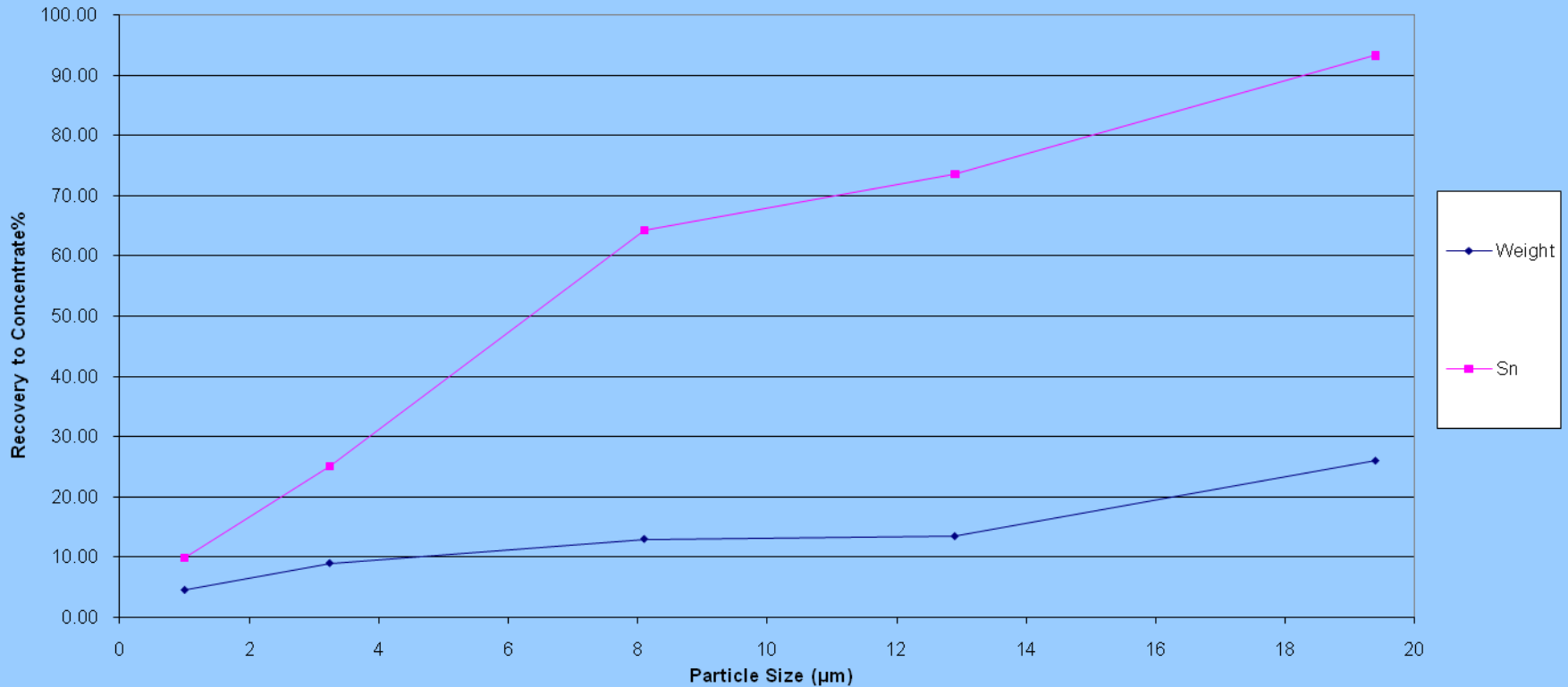


- Ultra high-G centrifuge (+600 G's)
- Mainly used in deslime streams
- Large range for mass yield
- Relatively low unit capacities

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Ultra-Fine Gravity Technology: High-G Centrifugal Concentrators

UF100 Slime Tailings Size-by-Size Recovery



Selective recovery down to 3 microns

How Can Different Concentration Techniques Work Together?

- Different mechanisms of separation
 - High G, low G
 - Size of particle bed
 - Use of water as a force
 - Constant force, pulsing/reciprocating force
- Different target particles
 - Method of concentrate collection affects particle type
 - Fine particles may report with water

Processes Working Together

- Spirals and Centrifugal Concentrators
 - Fine Hematite
 - Chromite
- Centrifugal Concentrators and Tables
 - Tantalum
 - Tin
- Centrifugal Concentrators and Flotation
 - Tungsten
 - Tin
 - Sulphide Gold

Summary

- High G-force gravity concentration can efficiently recover very fine particles
- Several different technologies have been created to target different types of metals and minerals
- Combining complementary technologies can multiply results, especially with gravity processes



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