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SMALL AND LARGE HEAP LEACHES - DIFFERENCES IN APPROACH

by

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Heap leaching has had a reputation as a bit of an underdog - a low-cost, low-technology approach to properties that couldn't be treated any other way. The recent spate of very large heap leaches, however, has served to dispel that concept.

For example, the Mesquite operation of Consolidated Goldfields in Southern California is a $70 million dollar investment with a production rate of 12,500 tons per day.

The reasons to use heap leaching instead of conventional milling are illustrated by two recent installations in Nevada - Paradise Peak in central Nevada (FMC) and Hog Ranch in the northwest corner of Nevada (Western Goldfields/Ferret Exploration).

As Figure 1 shows, the capital costs of a conventional mill are very significant. Paradise Peak cost $20,000.00 per daily ton of capacity, whereas Hog Ranch - a low-key heap leach installation - cost less than $2,500.00 per daily ton.

At a gold price of $400.00 per ounce and an 11 percent cost of capital, an orebody with a gold content of 0.08 ounces per ton would have to show a very high recovery differential - 40 percent - to justify the mill. This assumes that milling and heap leach operating costs are identical, but of course the mill operating cost is significantly higher than the heap leach.

In the case of Paradise Peak, the mill could be justified because the ore is high grade and contains a large amount of silver which is not readily heap leachable. But for many large orebodies, heap leaching is the choice from a financial standpoint.

Thus the choice of treatment - conventional mill or heap leach - is between two equally valid methods that have both "come of age".

Technology is like the U.S. auto industry, however. As the technology matures, it tends to get larger and to develop a lot of complications.

Has heap leaching grown out of its original role as a "Model T" method for treating small deposits?

The answer should be "no" - Large and small deposits may require technically different approaches, but each should be valid in the appropriate situation.

Why is it that properties show this reverse economy of scale? i.e., why do they get more expensive per ton of throughput as they get larger? There are at least three reasons -

1) Small operations are more closely controlled by people who care - sophistication in design can easily give way to personal "hands-on" involvement in daily operations.

For instance, Little Bald Mountain in northeastern Nevada, near Placer's Bald Mountain operation, was able to successfully run a conveyor stacking system directly on leach pads because the managers are there to supervise each conveyor movement; Hog Ranch requires an 18 inch gravel cover.

2) Small operations can afford to be more labor intensive - they generally have a shorter life and are higher grade than the large ones.

FIGURE 1. CAPITAL COST COMPARISONS - MILL AND HEAP LEACH

	PARADISE PEAK	HOG RANCH
DAILY ORE TONNAGE	4000	4000
TYPE OF MINING	OPEN PIT	OPEN PIT
TYPE OF PROCESSING	CYANIDE MILL	HEAP LEACH
CAPITAL COST	$ 80 MILLION	< $10 MILLION
CAPITAL + FINANCE COST/TON	$ 15.00	$ 1.90
CAPITAL COST, OZ GOLD/TON	0.0375	0.005
PERCENT ADDED RECOVERY NEEDED TO JUSTIFY THE MILL - ORE GRADE 0.08 OZ GOLD/TON	41 %	

FIGURE 2. CAPITAL COST COMPARISON - LARGE AND SMALL HEAP LEACHES

	MESQUITE	HOG RANCH	LITTLE BALD MTN
DAILY TONNAGE	12,500	4,000	400
CAPITAL COST - (INSTALLATIONS)	$ 50 MM	$ 7.0 MM	$ 0.5 MM
(TOTAL)	$ 70 MM	$ 10.0 MM	$ 1.0 MM
INSTALLATIONS, $/DAILY TON	$ 4,000	$ 1,700	$ 1,000

3) It's easier to modify a small operation to correct or work around initial design difficulties. LBM avoided any agglomeration in the first year even though the ore had a relatively high clay content; by selective mining and careful stacking, production losses were minor. Agglomeration was installed in year two, where it did not affect the initial capital requirement.

Another example of the "reverse economics" of size involves the amount of money spent initially on orebody development prior to the decision to proceed with production.

At what point should a company suspend exploration drilling and begin operations? Should it design operations only for proven tonnage, or for "expected" tonnage?

The small company might stop when it has enough tonnage to breakeven, particularly if it has good chances for developing additional tonnage later on. Usually, the sources of capital available to the small company are very expensive - stock offerings may appear to provide "free" money, but in terms of management time and future flexibility, this is very costly capital. Generally, the sooner a small company can begin developing a cash flow the better.

The large company, on the other hand, has more resources available to it - especially in the critical area of management talent needed to development or "massage" investment capital - its cost of capital is lower. At the same time, it generally places more importance on long-term stability and on financial measures of performance (i.e. return on investment becomes more important in relation to promotional value).

To accomplish its goals, the large company will need to show a decent return on investment and a decent life - and to do this, it will have to prove up at least one and a half times the amount needed for simple recovery of investment. In fact, to meet long-term stability goals, it may find it desirable to develop two or three times as much reserves as it needs.

The goals of a company do and should change. We have dealt with companies that - correctly - placed very small properties into production. Within a year or so, their minimum target for new properties often becomes much larger than the property they just developed. The first property was quite successful in both return on investment, and in allowing the company to out-grow it.

FIGURE 3. APPROACH TO ORE RESERVE DEVELOPMENT

LARGE COMPANY GOAL: TO CREATE LONG-TERM STABILITY
(DRILL FOR PLANNING PURPOSES)

SMALL COMPANY GOAL: TO DECREASE COST OF FUTURE CAPITAL
(DRILL ONLY ENOUGH TO JUSTIFY DEVELOPMENT)

RECOVERABLE GOLD CONTENT (OZ/TON)	TYPICAL HEAP GRADE (OZ/TON)	BREAK-EVEN TONNAGE	20% DCFROI TONNAGE
0.03	0.045	3,000,000	5,000,000
0.05	0.077	1,000,000	2,000,000
0.06	0.092	460,000	800,000
0.08	0.12	100,000	160,000
0.10	0.15	50,000	85,000
0.15	0.23	20,000	35,000

GOLD PRICE US $ 400/oz

CONCLUSION

Orebodies aren't usually flexible. The small orebodies need the small-company approach. This aspect of the business is generally acknowledged though not always appreciated.

If both approaches are valid, can they both be done by the same company? Probably not.

The concept of a small-company is not very well understood in business. A "small-company approach" is not created merely by lowering the financial goals of the big company. Small companies have more personal involvement by the managers. For a big company to get small successfully, it has to find a way to shift personal involvement from upper management to lower management.

A recent article in one of the business magazines made the point that - fortunately - companies aren't biological organisms. They don't merely grow up, grow old, wither away and die. Good companies may go through many cycles of being large or small, but it's probably difficult to be both sizes at once.

In conclusion, it should be said that most companies which have built expensive "Cadillac" operations - the Mesquite heap leach, the Paradise Peak mill - seem to have made valid decisions. These companies have relatively low costs of capital and very long-term goals of maintaining corporate stability.

The other end of the spectrum - low-cost, rapid development - is equally valid and important. It can be the road to success for small companies with big future plans.