UNIVERSITY OF
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SCALE-UP OF LABORATORY GRINDING AND FLOTATION TESTS FOR PLANT DESIGN AND OPTIMISATION

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Laboratory tests provide a means for precise research and routine ore assessment.

How useful are these tests for prediction of plant performance and plant optimisation??

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- The concept of a Work Index is good, but simple (wet) batch tests can produce similar information.
- The forces in the laboratory mill are small

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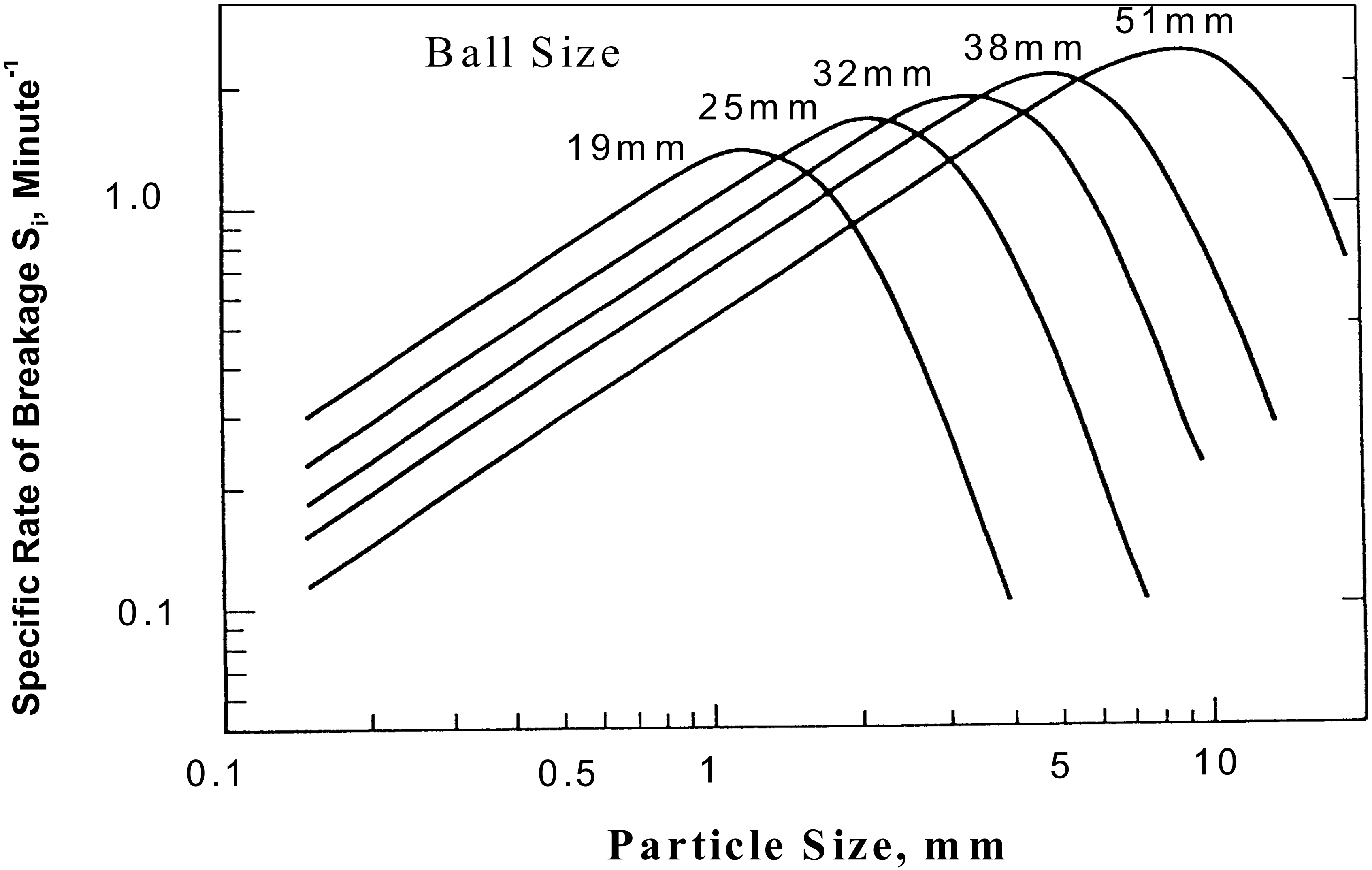
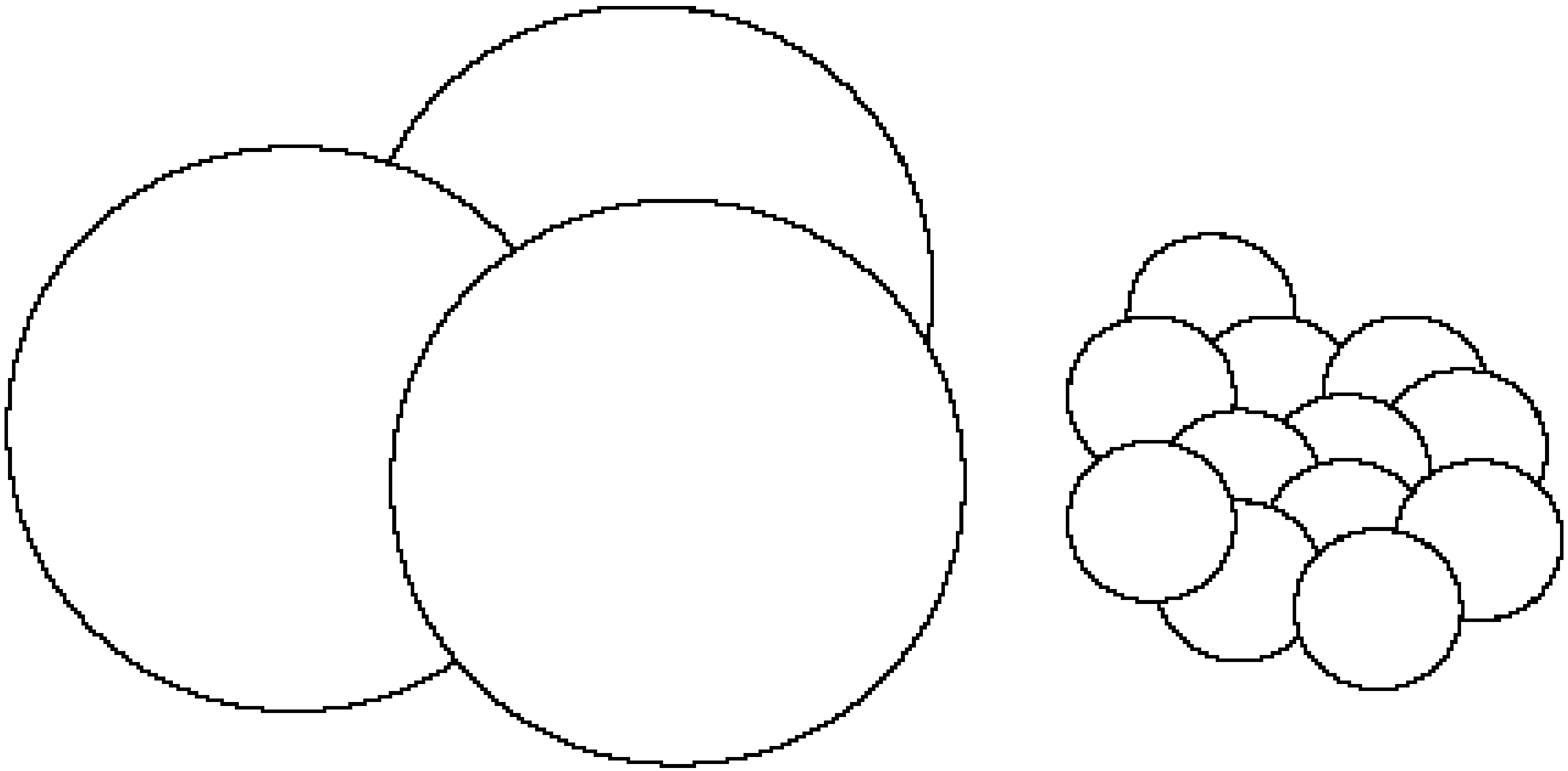
- The compression force required for complete breakage is α (mass)$^{0.66}$ α (diameter)^{2} α x-sectional area

Lab. Data on dry grinding (Austin)



Effect of ball size on number of contact points and forces



Observations on batch tests

- Addition of water has no effect (the theory of ball coating is speculation)
- Laboratory milling efficiency is adversely affected by high pulp viscosity
- Hence, use a relatively low solids concentration and measure power (torque) on all routine tests.

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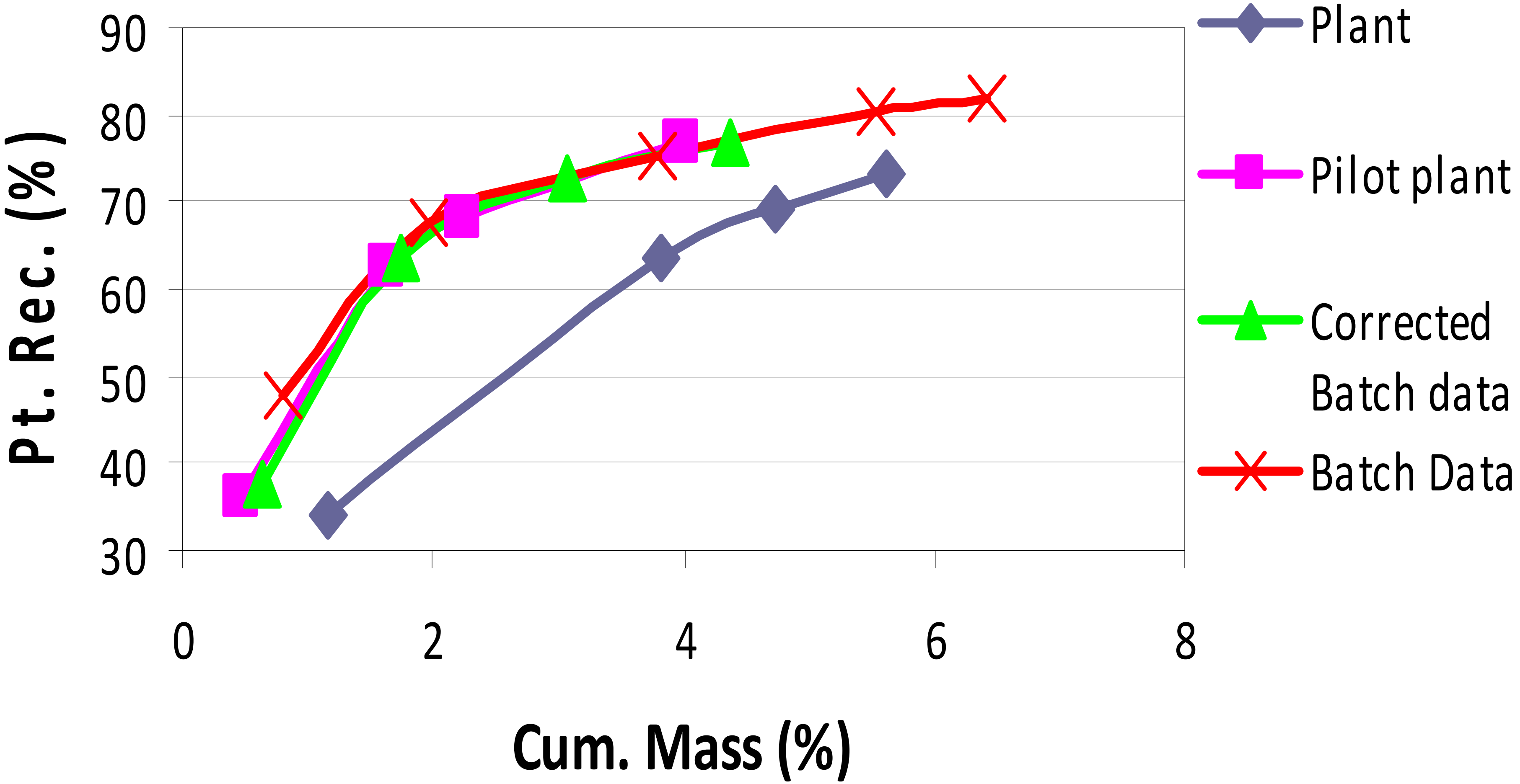
- Equivalent kinetics for lean ores?

Comparison of bubble loading

- Batch cell (5L): Relative loading =1
- Pilot-plant cell (50L) Rel. loading =2,2
- Plant cell (50 m^3) Rel. loading = 22

- Rate of flotation in the plant is about half that in a lab cell (Correction factor = 0,5)

Comparison of performance



Application of Models

Kelsall Model (1961)

	Non-Floating	Slow-Floating	Fast-Floating
Mass Fraction	a_0	a_1	a_2
Rate Constant	0	k_1	k_2

Can we use batch data to model a plant, by applying corrections?

- Batch tests can be done on samples of feed, concentrate, tails, etc. and Nodal Analysis can be applied
- This demonstrates that batch flotation rates are maintained – However it does not prove that the plant behaves in the same way

Data from the Cominco Red Dog Lead Cleaning Circuit (Runge et al, 1997)

	Final Cleaner (Column)		Cl. Scav. (2 x OK38)	
	Scale-up	Rel. to Pb	Scale-up	Rel. to Pb
Galena	0.077	1	0.80	1
Sphalerite	0.053	0.68	0.68	0.85
Pyrite	0.039	0.51	0.68	0.85
N.S. Gangue	0.060	0.78	0.56	0.7

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- The Red Dog data showed that separations achieved in the batch tests were significantly worse than the plant
- The use of different scale-up factors for each mineral, allows the model to fit the base case (a force fit)
- Prediction of the performance of a new circuit configuration would be difficult

Is there another option??

Platinum Flotation Circuit