'There is one thing stronger than all the armies in the world, And that is an idea whose time has come' Victor Hugo.

The papers in this issue are from the annual colloquium in which students are given the opportunity to present a report on project work undertaken as part of their undergraduate training. In publishing a selection of the papers it is not the intention to announce the advent of great new advances in technology, but rather to produce a window on the best examples of the state of the nation for perusal by the collegiate of professionally qualified practitioners in mining, mineral processing, and metallurgy.

I use the word collegiate specifically because our universities and technical colleges have been combined and offer degrees and diplomas respectively to their graduates. The membership of the Southern Institute of Mining and Metallurgy comprises both graduates from universities and technicians or diplomates from technical colleges. There was a time when it was firmly advocated that for every graduate engineer there should be between two and four technicians. With diplomas from the 'technical colleges', I doubt if we are anywhere near this ratio.

We make no apology for publishing a suite of papers where our usual selection criterion, namely one of significant well-demonstrated advances in technology, is of secondary importance. The primary purpose is to provide at least a glimpse of the health, status, and acceptability of our national professional tertiary educational and research structure. In this age of internet engulfment with scams and fraudulent misinformation, we have, in common with the legal, medical, and financial professions, a duty to provide equivalent forensic technical judgement on matters of community and national importance. Let us be under no illusion that the credentials of the profession rest with our universities and colleges being at the forefront of new technology and disciplined integrity in competence. It is also important to recognize that as regards national priorities (for example, job creation) the contribution and ability of the technically trained professional is every bit as relevant as that of the academically trained scientist or engineer.

It is thus not usually appropriate to comment on detailed technical novelty aspects in undergraduate assignments.

Nevertheless, my first comment is to express delight in a publication from a newcomer to the mining and metallurgical research community in the form of the Department of Chemical Engineering 'with specialization in minerals processing, research focus area for chemical resource beneficiation', North-West University, previously the University of Potchefstroom. Let us hope for many more contributions.

The paper selected from this Department is:
'Application of membrane technology in a base metal refinery', by D.W. Nel, P. van der Gryp, H.W. Neomagus, and D. Bessarabov.

This paper demands comment in some detail. It is in the category of a significant novel contribution. It examines the new techniques of nanofiltration through a commercial membrane (of a confidential nature) to separate sulphuric acid from a solution of acid-bearing nickel

sulphate derived from electrolytic deposition at the Rustenburg Platinum Refinery. This is a common problem in the recovery of metals in base metal hydrometallurgy (including as a matter of interest, the treatment of acid mine drainage).

Nanofiltration is a difficult technology involving ultrahigh pressures of tens of atmospheres using ultra-thin membranes and thus with a cost structure of the same order as reverse osmosis. It takes advantage of the relatively large hydrated radius of the nickel ion compared with hydrogen, sulphate, and sodium ions, the latter being an impurity arising from the neutralizing of acid using sodium hydroxide in the previous processing steps.

The separation factors, while promising, were far from being competitive in comparison with alternative options. Removal of acid is an important factor in the cost of electric power needed to deposit nickel and, for that matter, other base metals.

I mention such detail because this is an excellent example of the need for a portfolio approach, whereby the probability of economic success is enhanced by multiple options. As Nel and his sponsors are certainly aware, there is the 'ion retardation' technique, already in use for nickel processing in South Africa. It offers huge scope for optimization and extended applications.

With new concepts in continuous countercurrent ion exchange (CCIX) systems and with its feature of 100 per cent separation factors between acids and most base metals, it is a serious contender in hydrometallurgy.

There is also the approach where the acid can be neutralized and the base metals, including nickel, precipitated by using the base form of an anion exchange resin, thus avoiding the contamination of the circuit with alkali metals. The base metal hydrate can be used to neutralize the acid formed during electrodeposition of the metal. Also coupled with this option is the possible use of dipolar cell technology to regenerate the IX resin, with a wide application potential. There is also the nanotube/membrane system developed by Dr Sunny Iyuke of the Chemical Engineering Department at Wits University (see the news release in this issue of the Journal).

As indicated in many previous comments there is a great opportunity to promote a portfolio approach to this area of hydrometallurgy, with high probability of being able to meet the challenge of exploiting our vast low-grade nickel deposits and the several other low-grade base metal options in Namaqualand.

The establishment of an active national group looking at such a portfolio of research in conjunction with several sponsors would have immense benefit to the industry. The proximity of Potchefstroom to the western gold and platinum mining industry, and the fact that Potchefstroom has also a well-known agricultural faculty, would offer great potential for job creation, as has been mentioned many times. The chemical engineering department at Potchefstroom would be an excellent focal point.

Many of the other papers in this issue are pregnant with possibilities of similar portfolio contributions in the field of mining and metallurgy. The problems of the cost of diesel fuel have

many broad-based project options.

Blasting technology, in the light of the latest computer modelling advances, well justifies a research group looking at problems and options on a broad basis. Similar comments apply to alternative sources for electrical power generation at a more acceptable cost, and such a portfolio would benefit ferroalloy and aluminium, beach sand, and titanium resource utilization. This in turn could lead to alternatives to stainless steels.

Of immense importance is the paper on the rationalization of methods for determining the tensile strength and other physical properties of mild steel, a topic I would have thought would have been resolved many decades ago. The point of this is that the whole field of physical metallurgical technology must be rapidly brought up to date, with many skilled practitioners available for all the concepts of job creation by way of metal and mineral beneficiation.

These are much publicized challenges and I must return to the main point of the publication of this issue, which is to provide a much too brief a window on our total tertiary college education, the nursery of national competence.

The Institute and its publication cannot stand aloof from a much greater interaction with our research capability, which is so importantly represented by the students, the graduates, the diplomates, and the sponsorship of research activity and its publication to promote debate by the whole collegiate of our mining and metallurgical fraternity. This must include international collaborators and investors in risk capital portfolios.

Perhaps as a bonus this issue will give rise to a number of rapidly maturing ideas for global exports, the essence of job creation.