TUESDAY, AUGUST 23, 2005, A.M.

SESSION 18: INTERNATIONAL CONFERENCE ON NICKEL AND COBALT

PLENARY SESSION
Sponsor(s): The Non-Ferrous Pyrometallurgy Section, Metallurgical Society of CIM
Room: Doll
Chair(s): J. DONALD, Inco Technical Services Ltd., Canada
R. SCHONEWILLE, Falconbridge Ltd., Canada

PAPER 18.1—8:30 (INVITED)
RESOURCES, ECONOMICS, ENVIRONMENT AND TECHNOLOGY AS DRIVING FORCES IN THE BASE METALS INDUSTRY.
A. DALVI and G. BACON, Inco Technical Services Ltd., Canada

Resources, Economics, Environment and Technology are the major driving forces in the base metals industry. However, these factors are intertwined and together will propel the industry in the future. The demand for metals has grown with economic expansion, between 2 to 4 % p.a. The current growth cycle has been driven by economic expansion in China where the demand for base metals has risen from ~ 7 % of the world demand in the 90's to ~ 25 % of world demand today, and rising. Metals are commodities and their demand and price are cyclical. Historically metal prices have declined in constant dollars. This has put pressure on the industry to reduce costs, increase productivity and increase the scale of operation to gain economies of scale. Due to resource depletion and capacity expansion the industry is driven to expand its reserve and resource base. However, in the case of sulphide deposits of copper and nickel it is not succeeding. For nickel the laterites represent a vast source at this time. Their development requires development of new technologies to make these resources economic. Emission reduction is being increasingly mandated in most jurisdictions with all governments enacting progressively more stringent regulations. The industry has been responding with technological innovation. With Kyoto protocol there is a push to reduce energy intensity in metal production. Technological innovation is driven by all the other factors and is leading to novel ways of doing exploration, mining and processing, that would maximize resource delineation and utilization, reduce costs, increase productivity, reduce energy consumption and maximize asset utilization. In processing, continuous and more intensive processes are being adopted; automation and process control is increasingly being implemented. Use of computers in various aspects of design, analysis and operation is leading to increased efficiencies and reduced costs. Development of alternative technologies such as Pressure Acid Leach of laterite for nickel, bio-leaching, heap leaching, SX-EW etc are being adopted to achieve the aims of the industry.

PAPER 18.2—8:55
THE GAP NICKEL MINE, LANCASTER COUNTY, PENNSYLVANIA AND THE AMERICAN NICKEL WORKS, CAMDEN, NEW JERSEY 1860 – 1890.
J. MATOUSEK, U.S.A. and
D. CHADWICK, U.S.A.

Between 1860 and 1890 -- from the time of the American Civil War to the last decade of the 19th Century -- nickel production in North America was dominated (even monopolized) by the output of the industrial complex of the Gap Nickel Mine near Lancaster, Pennsylvania and the American Nickel Works in Camden, New Jersey. In some years, from one sixth to one third of the world's metallic nickel supply came from this enterprise. Mining and smelting were conducted at Lancaster; a matte of high iron content was shipped to Camden for pyrometallurgical and hydrometallurgical refining to produce nickel metal, copper sulfate, and cobalt oxide. The high purity nickel product was rolled into sheet for marketing, primarily for coinage, as nickel had few other uses at that time. The undertaking experienced all of the problems that face the mining and metallurgical industries of today: declining reserves, high labor and fuel costs, high transportation costs, fluctuating demand and prices, pollution concerns, and foreign competition. The technical features of the geology; the mining, smelting, and refining operations; and some of the economic aspects are assessed. The view is taken from that of the present time -- seeking those lessons from history that we are supposed to learn or face the prospect of repeating the mistakes of the past.

PAPER 18.3—9:20 (INVITED)
AN OVERVIEW OF SOUTHERN AFRICAN PGM SMELTING.
R. JONES, Mintek, South Africa

The two largest known PGM deposits in the world are the Bushveld Complex in South Africa and the Great Dyke in Zimbabwe. It is therefore not surprising that the majority (about 4.7 million ounces or 145 metric tons per annum) of the world's platinum is produced in Southern Africa. Primary smelting of ore concentrates is carried out in that region by five companies, namely Anglo Platinum, Impala Platinum, Lonmin Platinum, Northam Platinum, all of South

Africa, and Makwiro Platinum in Zimbabwe. The only other primary smelter of platinum group metals (PGMs) is Stillwater Mining of Montana, USA, although very significant quantities of PGMs are produced as co-products by Norilsk Nickel of Russia. Smaller (but still significant) quantities of PGMs are produced by Falconbridge and Inco of Canada, also as co- products from nickel sulphide smelting. There are many similarities between PGM smelting and nickel sulphide smelting, and the range of technologies in use includes six-in-line rectangular electric furnaces, three-electrode circular AC furnaces, Peirce-Smith converters, and Anglo's ACP (based on Ausmelt technology). PGMs are also recovered from waste materials using DC arc furnace technology.

PAPER 18.4—9:45

THE CHANGING PATTERN AND OUTLOOK FOR NICKEL USE IN CHINA.

B. WATERS, Nickel Development Institute, Canada

World wide applications for nickel use will be summarized and examples of those uses given. Nickel products are critical to many important aspects of modern society. These products are just as important for modern China as they are in other parts of the world. It is argued that future pattern of nickel use in China should be expected to be very similar to that in the rest of the developed world. Total use of nickel in products in China is already very large. In 2003, it was the largest market for stainless steel (nickel containing) in the world. A survey of Chinese stainless steel applications will be presented. Current high nickel prices have revived speculation about substitution, particularly for nickel containing stainless steels. The presentation will discuss some of the complicating factors that need to be taken into account when considering substitution. These factors are as valid in modern China as they are in other developed economies. Recent substitution efforts and the reaction to them will be examined. The Nickel Institute position regarding appropriate application of the various grades of stainless steel in coordination with the application guidelines for low nickel stainless steels being developed by the global stainless steel industry, will be discussed. Price-motivated substitution in China, and elsewhere, will occur but it is argued that the extent will probably be limited.

COFFEE BREAK—10:10-10:30

PAPER 18.5—10:30

THE CHANGING CANADIAN NICKEL SMELTING LANDSCAPE - LATE 19TH CENTURY TO EARLY 21ST CENTURY.

S. MARCUSON and C.M. DÍAZ, Inco Technical Services Ltd., Canada

In the late 19th century, the discovery of rich nickel-copper sulfide ore bodies in Sudbury and the need for tonnage quantities of nickel for armor plate provided the foundation for establishing the Canadian nickel industry. For almost 50 years, International Nickel was the key player. In 1930, Falconbridge Nickel entered the field. These two companies are still the main Canadian nickel producers. This paper discusses the factors that have influenced the evolution of nickel smelting processes. The initial Sudbury ore smelting and copper-nickel separation technologies were imported from abroad. In 1937, International Nickel established a process research laboratory in Copper Cliff. The explosive post WW II industrial development created a strong demand for a broader variety of nickel products. For both International Nickel and Falconbridge, R&D became an essential business tool to succeed in the new market scenery. In the last few decades, new technologies were developed and commercialized to respond to the rising energy costs, environmental liabilities and legislation, the advent of nickel laterites as an important source of new metal, the appearance of new nickel producers, and the resulting need to increase productivity. Canada thus became an important exporter of technology. In this paper, the authors review this history with the objective of highlighting the forces that have triggered the most important changes in Canadian nickel smelting.

PAPER 18.6—11:15 (INVITED)

A PERSONAL VIEW OF THE NICKEL INDUSTRY IN AUSTRALIA – WHERE HAVE WE BEEN AND WHERE ARE WE GOING?

J. CANTERFORD, Process Technologies Australia Pty Ltd., Australia

The nickel industry in Australia has followed the general pattern apparent in many other regions - lots of ups and downs, successes and failures, but always plenty of challenges. Some of these can be attributed to local geographical and infrastructure factors, others to a healthy mix of corporate good luck and management countered by decisions, that in retrospect, were less than optimum. The roles of the several entrepreneurs has certainly added plenty of spice! In terms of processing technologies, there was an initial heavy reliance on the use of “off the shelf” commercially proven processes such as ammonia leaching of concentrates and matte, and flash smelting. Over the past decade there has been an increasing dominance of plant modifications and process technologies that have been developed “in house” in order to enhance project economics and exploit lower grade and more complex resources. This presentation provides an overview of the past 35 years of the major developments in the Australian nickel industry and concludes with some guesses as to where we will be in another decade or so.