



Art Soregaroli, Vice-President Exploration
Harlan Meade, Exploration, Western Region
Mining Division, Westmin Resources Limited

Promise of the Stewart area, British Columbia

The recent option of the Silbak Premier property is part of an exploration play by Westmin Resources aimed towards the establishment of a major mining operation in the Stewart area of British Columbia. The addition of the Silbak Premier property compliments the Big Missouri property which has been the centre of major exploration by Westmin since 1979. Both properties formerly produced gold, silver and base metals.

The Stewart area is a heavily mineralized area of volcanic, intrusive and sedimentary rocks containing literally thousands of mineral showings. Two mines are presently operating in the area; the Granduc copper mine operated by Canada Wide Mines (Esso Minerals Ltd) and the Scottie Gold Mine located about one mile south of the Granduc mill. During the past year Esso Minerals has also reported significant gold-silver assays from drill holes at Sulphurets Creek, north of Granduc Mine and from the Consolidated Silver Butte Property which lies between the Big Missouri and Silbak Premier properties.

BIG MISSOURI

Westmin was initially attracted to the Stewart area when invited to examine the Big Missouri property of Tournigan Mining Explorations Ltd. Tournigan president John Hembling had succeeded, after several years of diligent

bargaining, in consolidating a large group of contiguous claims (177 units) covering many old showings at and around the former Big Missouri Mine. The Big Missouri Mine, operated by Cominco from 1938-1942, produced 847,615 tons with a recovered grade of 0.069 oz/ton of gold, 0.062 oz/ton silver plus some lead and zinc. Ore was treated in an underground mill with a capacity of 750 tpd.

In 1979 an agreement was completed whereby Westmin will earn a 70% interest in the Big Missouri property through the annual purchase of Tournigan shares to a total of 700,000 shares at a cost of \$1-million and through annual exploration expenditures totalling \$1.7-million by 31 Dec 1984. A feasibility study must be completed by 1 June 1985.

Provisions in the agreement allow Westmin to purchase an additional interest in the property at the time of commercial production. Tournigan retains a 30% net profits royalty (less the Westmin option) after payback of capital and preproduction expenses. To the end of 1982 Westmin had spent over \$2-million exploring the property and had purchased 400,000 Tournigan shares.

Initial exploration during the first year was dedicated to detailed re-evaluation of the geology and ore controls supported

by geochemical studies, detailed sampling, trenching and a few drill holes for stratigraphic purposes. Results of these studies established a stratigraphic control for the gold-silver-base metal showings. Evaluation of the many showings on the property using such a stratigraphic model resulted in the partial delineation of four potential open-pit zones within an area one mile in diameter. Gold, silver and variable amounts of zinc, lead and copper are concentrated in stratigraphically controlled sulphide zones in andesitic volcanic rocks of Jurassic age (Hazelton Group). Both the host rocks and the mineral zones dip gently to moderately westward generally subparallel to the topography, thus rendering them amenable to open-pit mining.

Three mineral-bearing silicified and/or bleached horizons have been identified within the andesitic host rocks. Individual horizons are up to 98 ft thick, but generally consist of several closely spaced sulphide bands each of which is 15 to 30 ft thick. Several hundred feet of barren or locally mineralized andesite separates the horizons. Each horizon has certain characteristics which help distinguish it from the other horizons.

The Lower Horizon hosts the Dago Zone, the most intensely explored gold-silver zone on the property. The Dago Zone has been explored by means of several adits and one shaft from surface as well as by trenching and diamond and percussion drilling and is thus the best understood of all the mineral zones. The zone is contained within a block 800 ft long, 100-300 ft wide and up to 100 ft thick. Dago Zone occupies a ridge making it especially conducive to open-pit mining.

The Middle Horizon hosts the S-1 and the Martha Ellen Zones. The S-1 Zone, which is the surface expression of the previous underground stopes in the Big Missouri Mine, has been partially drilled,

Drill Results. Big Missouri property — Martha Ellen Zone

Hole	From ft	To ft	Length ft	Au oz/t	Ag	Cu	Pb %	Zn
82-51	34.3	82.3	48.0	0.171	2.13	0.32	1.35	4.35
85-52	5.9	19.0	13.8	0.069	1.55	0.36	1.14	2.38
82-53	6.0	26.9	20.9	0.061	2.05	0.10	0.77	2.78
82-55	99.0	190.0	92.0	0.083	2.79	0.35	0.77	3.29
82-64	83.3	119.1	35.8	0.194	1.47	—	0.64	2.14

but remains open in three directions. Calculation of open-pittable reserves in the S-1 Zone must await completion of additional drilling.

The Martha Ellen Zone, which has long been known from surface showings, was first drilled in 1982 and has produced some of the best diamond drill intersections on the Big Missouri property. The zone contains higher base metal content than other known zones on the property and is exposed in surface trenches and drill holes over an area exceeding 2000 ft along strike giving the zone the potential of becoming the largest on the property. The boundaries of the zone have not been established. Ten holes have been drilled in the south part of the zone, the most significant of which are shown in the accompanying table.

The Martha Ellen Zone is undefined and is open in at least three directions. This zone could develop into the most important zone on the Big Missouri property when traced down-dip by diamond drilling.

The Upper Horizon contains the Province Zone which occupies the top of Big Missouri ridge. The zone has been exposed in a series of long bedrock trenches which extend across the zone. Sampling of these trenches and diamond drilling have essentially defined the limits of the zone.

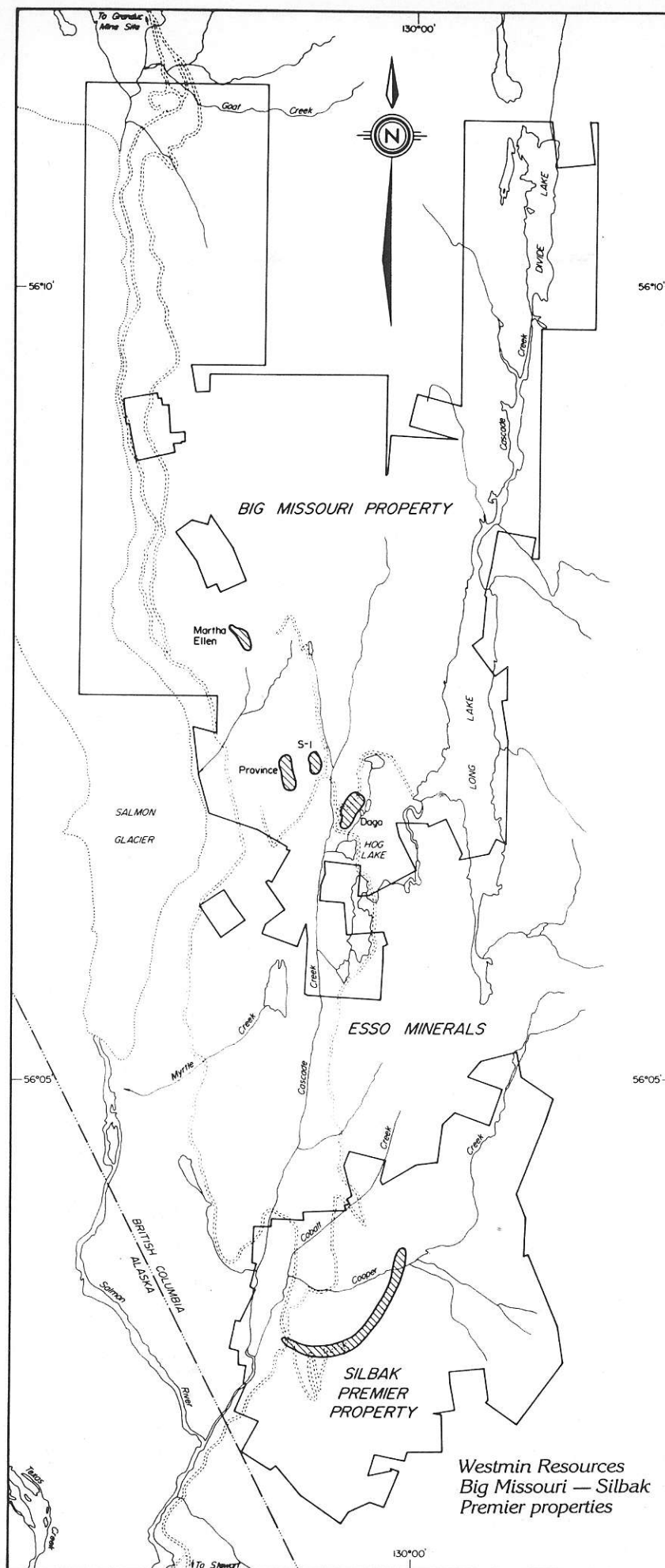
A conservative drill indicated, geological, open-pit reserve of the Dago, Province and S-1 Zones was released in April 1982 based on results of the 1981 program. The figures are 929,000 tons grading 0.103 oz gold equivalent per ton (undiluted) using a cut-off of 0.04 oz gold equivalent per ton, where gold equivalent is calculated as 1 oz gold equals 42 oz silver. The addition of the Martha Ellen Zone and upgrading of the Dago and S-1 Zones will add considerable tonnage to this reserve estimate. Each of the four zones has the potential for between 400,000 and 1,000,000 tons of ore amenable to open-pit mining at a grade of approximately 0.10 oz/ton of gold equivalent.

During the period 1979-1982 a total of 198 diamond drill holes totalling approximately 28,000 ft and 173 percussion holes (9500 ft) were completed. Exploration has concentrated on zones with open-pit potential. Underground targets have not been tested.

SILBAK PREMIER

In the fall of 1981 Westmin was invited by British Silbak Premier Mines to examine the former Silbak Premier Mine property and evaluate the voluminous data relating to the property.

An initial agreement was reached between Westmin and British Silbak Premier which later required



considerable re-negotiation and revision, but resulted in completion of a formal agreement in March 1983. Terms of the agreement called for five annual payments of \$300,000, each of which purchases a 2% net profits interest in the property. In addition, Westmin must spend \$5-million on exploration/development during the 5-year period to earn a 50% interest in the property. After expenditure of \$2.3-million, Westmin is vested in a 10% carried interest. British Silbak Premier can elect to participate as a joint venturer at the 50% level or dilute to a 20% net profits royalty after payback.

The Silbak Premier Mine was a highly successful mine over most of its 50-year life (1918-1968) during which over 4,700,000 tons of ore with a recovered grade of 0.384 oz/ton gold and 8.03 oz/ton silver were mined and milled. Lead, zinc and copper were sporadically recovered. Most production occurred between 1918 and 1953 and during this period the mine generated in excess of \$20,000,000 in dividends.

Although detailed field studies have not started, an evaluation and replotting of all available data on a common base have identified several surface and underground target areas that will require concentrated exploration programs. cursory examination of mineral zones and maps suggest the gold, silver and base metals on the Silbak Premier property occur both in stratigraphically controlled zones and in cross-cutting structures. Although the property contains minor quantities of drill-indicated reserves and moderate quantities of possible reserves, a considerable amount of intense exploration is required to prove such reserves and to evaluate new zones. The property has the potential to again produce several million tons of moderate grade ores.

Exploration in 1983 will concentrate on detailed surface and underground geological studies and on evaluation of near-surface exploration targets. Terms of the agreement require expenditure of at least \$500,000 in 1983.

Future development of the properties will depend upon exploration success and perhaps upon the success of other properties in the area. The Big Missouri and Silbak Premier properties are only five miles apart and ores from the two properties could be treated in a common mill complex. Other factors, such as timing, metal prices, etc could dictate the development of each property on a 'stand-alone' basis. Of course, a third alternative worthy of consideration is the shipment of ore to a custom concentrator. Westmin will keep open its options during the continued exploration and development of these important gold-silver-base metal properties. W/M



Roman Pachovsky PhD
Supervisor, Heavy Oil

Development of heavy oil expertise helped weather metal price slump

During the past two years of extremely depressed metal prices, Westmin's Petroleum Division has been generating the major portion of the company's revenues and profits.

And, Westmin's heavy oil properties have become a major contributor to Petroleum Division results. A significant portion of the company's proven petroleum reserves are contained within the Lloydminster heavy oil corridor of east-central Alberta. In this area alone, conservative estimates have placed the amount of oil-in-place in the billion cubic metre range with Westmin's share of the total estimated at 200-million m³ (1.3 billion barrels). Despite the recognized enormous potential of this resource, it has only been during the last three years that Westmin has begun to tackle the unique challenges of establishing economic production from its heavy oil holdings.

Heavy oil is a thick petroleum hydrocarbon which is distinct from conventional oils on the one hand, and bitumens or tar sand material on the other. Conventional oils flow very readily in the ground and when a well is drilled into a conventional oil pool, the oil flows into the well and is pumped to the surface. Typically, such a well can produce about 30% of the oil-in-place at rates of several hundred m³/day. In the industry, this is called primary production. Bitumen, however, does not flow at all and cannot be produced by primary production methods.

Heavy oil falls into an area somewhere between these two extremes. A typical heavy oil well can flow under primary production but the producing rates are low, with an average being about 3 m³/day, and the oil recoveries ranging

about 1% to 3% of the oil-in-place.

In addition, there are several unique problems associated with the recovery of these heavy oils. Unlike conventional oils, they are normally found in unconsolidated sands, like beach sands, which can flow along with the oil into the well. These sands can damage and seize up pumping equipment and this adds to operating costs.

Heavy oil also contains more impurities than conventional oils and this makes them less desirable to most petroleum refiners. As a consequence, prices for heavy oils are lower than conventional.

The combination of low producing rates, higher operating costs, lower selling prices and limited markets remained a major obstacle to serious heavy oil development until the late 1970s.

Westmin, however, recognized that such a vast resource could not be ignored and in 1978 began drilling exploratory wells on its heavy oil acreages to identify the potential and try to produce some of the wells. Of the 13 wells drilled that year, eight proved to have producing capability. Over the next three years, an average of 15 wells per year were drilled and through this drilling program Westmin identified three major producing areas in the heavy oil corridor — Vermilion, Morgan and Lindbergh. The most promising of these is the Lindbergh area and consequently, the majority of the drilling over the past two years has been concentrated here.

In 1972, Westmin established a major field office at Elk Point. To date the company has drilled 101 heavy oil wells (41 in 1982), with 71 of these being in the Lindbergh field.

The Lindbergh field is located approximately 75km northwest of Lloydminster, Alberta. In this field, Westmin has interests in 75 sections (square miles) of land, of which 34 have identified heavy oil potential. The majority of the lands are held as Mineral Title Acreages which are not subject to a royalty or rental payments to the Crown, but are subject to a nominal mineral tax.

Currently, the most promising Lindbergh locations are being developed on primary production with 66 of the 71 wells drilled producing an average of 3.7 m³/day of oil per well. Most of the 1982 wells were development locations and as such were drilled on a 16 hectare (40 acre) per well spacing. Westmin plans to drill an additional 30 wells in the Lindbergh field in 1983. The majority of Westmin's wells in Lindbergh are performing better than those of neighboring operations due partially to the reservoir quality. However, we at Westmin like to think that much of this better performance is also due to better drilling and completion methods.

IMPROVING OIL RECOVERY

One of the major considerations facing any heavy oil producer is how to improve recovery from the expected primary recovery of 1% to 3% of the oil-in-place. Because of the high viscosity (sluggishness to flow) of the heavy oil, conventional techniques such as water-flooding, which work in conventional oil pools, are not applicable in heavy oil reservoirs. The logical solution is the application of heat to reduce this high viscosity and enable the oil to flow more freely. Such techniques are called thermal enhanced oil recovery methods and can increase oil recoveries anywhere from 15% to 30%, or higher.

Westmin has evaluated the applicability of various thermal enhanced recovery schemes to the Lindbergh acreage and concluded that the steam stimulation or huff and puff process appears to be the most promising for near term development of 10 prime sections. Simply stated, steam

stimulation involves injecting a pre-determined volume of steam into a well to heat the oil in the reservoir and producing the heated oil back through the well (a huff of steam and a puff of oil). This technique results in a temporary increase in the producing capability of the well. The combination of injection and production phases is referred to as a cycle and typically, an individual well can undergo four or five such cycles before the well becomes uneconomical to produce.

In an effort to improve oil recovery from its heavy oil wells, Westmin began experimental testing of the steam stimulation process on one well in the Lindbergh field in May of 1982. The results from this test have been very encouraging in that oil production rates several times the rate of primary production have been achieved. Consequently, a second steam cycle has been initiated at the same well, and a first steam stimulation cycle has been commenced on another well. Further work on steam stimulation is planned for 1983 and, hopefully, an additional six wells will see steam injection during the year. The 1983 tests are intended to provide information on Lindbergh well performance under a multi-cycle stimulation mode and determine the effects of reservoir quality on production performances. Results from these tests will play a major part in determining the future role steam will play in heavy oil development in Lindbergh. Conservatively, Westmin estimates that some 8-million m³ (50-million barrels) of oil can be recovered from its lands using steam stimulation.

Following the steam stimulation of wells, further recovery enhancement can be obtained through application of a steam drive process or the in situ combustion (fireflood) process. In the former process, steam is injected continuously into a well and hot oil is produced from adjacent wells. With fireflood, air is continuously injected into a well to sustain the combustion of a

portion of the oil in the reservoir, thereby generating heat necessary to warm the remaining oil and hot oil is produced from adjacent wells. Generally, in situ combustion can be applied to a broader portion of the reservoir but steam drive is significantly less complex to operate. The application of either process to the Lindbergh area, however, is still very much in the conceptual stage and more process development is required before Westmin would be prepared to commit to either process. Preliminary estimates suggest that at least an additional 15-million m³ can be recovered through application of these processes.

For both of these processes, a much denser well spacing will be required and one of 4ha (10 acres) per well is expected to be necessary. Westmin is presently evaluating the drilling of deviated wells as a field development strategy in an effort to mitigate the impact of such dense well spacing on surface land use.

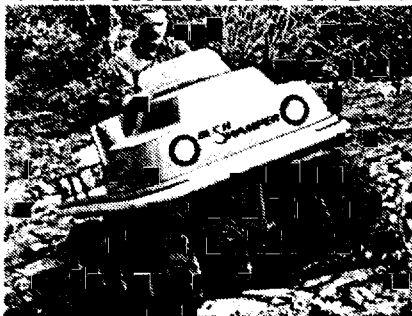
Westmin's success in developing this difficult to produce resource has been a model to the industry and is dramatically underlined by the fact that the company has been able to more than double its daily heavy oil production every year from a modest 16 m³/day in 1979 to a respectable 240 m³/day in 1982. Barring any major difficulties, Westmin should once again double its production by year end 1983.

As for the future, Westmin is fully committed to developing heavy oil. The company anticipates drilling 30 wells a year over the next several years and expanding its experimental work in evaluating the applicability of steam processes to the Lindbergh area. These plans will require Westmin to double its Elk Point staff in 1983.

In view of the fact that heavy oil production now represents a major source of revenue for the company, and that the current plans will only strengthen its importance relative to Westmin's other oil and gas producing areas, the future does indeed look bright for Westmin and heavy oil.

W/M

THE 16/24" WD MULTI-TERRAIN BRISTOL BUSH SWAMPER



**TOUGH EQUIPMENT
FOR TOUGH JOBS
WE MAKE IT — YOU PROFIT BY IT**

IN SERVICE WITH

• Abitibi Price Inc. • Energy Mines and Resources Canada • Inco Metals Company • Lockhart Exploration Services Ltd. • Long Lac Explorations (1982) Ltd. • Midwest Drilling • Northern and Central Gas Corp. Ltd. • Ontario Hydro • Ontario Ministry of Natural Resources • Powertel Utilities Contractors Ltd. • Utah Mines Ltd.

DEALER INQUIRIES INVITED

MANUFACTURED BY: BRISTOL MACHINE WORKS LIMITED

2040 ALGONQUIN RD. N. SUDBURY, ONTARIO CANADA P3E 4Z6. TELEPHONE (705) 522-1550