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RAW MATERIAL REQUIREMENTS OF THE NATO COUNTRIES AND OF THE USSR, DEGREES OF SELF-SUFFICIENCY AND THE INTERNATIONAL REPERCUSSIONS OF THESE REQUIREMENTS

Note by the Secretary General

This report deals with the dependence of the Allied countries and the Soviet Union on outside supplies of certain industrial raw materials of major economic-strategic significance. It was drawn up by the Economic Committee mainly in the light of the conclusions of a reinforced meeting with national experts.

2. This report is forwarded to the Council for information.

(Signed) Joseph M.A.H. LUNS

This document includes: 3 Annexes

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REPORT BY THE ECONOMIC COMMITTEE

SUMMARY

(i) The reinforced meeting of the Economic Committee has confirmed that the NATO countries rely for a high proportion of their critical strategic supplies exclusively, or to a large extent, on a few producing countries in Southern Africa, among the Communist countries in South East Asia or in other parts of the Third World.

(ii) However, it was also noted that NATO's vulnerability in this respect had been reduced, at least in the short term, because of the improvement in the world markets for these commodities as a result not only of the effects of the economic crisis on demand but, for certain materials, of the improved supply position in various countries. This is particularly true of cobalt - for which there is surplus production capacity - and of titanium for which the Western countries (with the help of Japan) are now self-sufficient and independent of the USSR.

(iii) Furthermore, the various practical measures designed to reduce the dependence of the NATO countries on outside suppliers - particularly stockpiling - were reconsidered or, at the very least, referred to in the course of the discussions.

(iv) Although its overall raw materials position is favourable, the USSR is dependent on external sources for a relatively high proportion of its consumption of certain metals and minerals of great importance for industry, such as aluminium, cobalt, tin, molybdenum, tungsten, fluorspar and, to a lesser degree, lead and zinc. The degree of dependence changed very little in 1980 (except in the case of molybdenum for which it increased greatly). The difficulties encountered by the Soviets in the development of their mining capacity is explained mainly by the exhaustion of certain deposits, the shifting of supply sources to remote areas, with the consequent increase in operating costs, and also the shortage of manpower.

(v) The Soviet authorities have shown a certain flexibility in dealing with these production problems. The authorities also seem to have chosen the relative advantages of deferring the development of certain costly production capacity in favour of imports. There has also been a drive to economize on the use of raw materials in industry.

(vi) Virtually no information is at hand on Soviet raw material stockpiles concerning both the volume and composition of any reserves and stockpiling policy as a whole.

(vii) At the moment, Soviet mining activities in the Third World are not likely to conflict with the economic interests of members of the Alliance. Since the agreements concluded by Moscow cover a very reduced range of materials, which are not among the most strategically important, the impact on the market has been marginal.

(viii) The experts taking part in the Economic Committee meeting suggested that the exchange of studies on raw materials should be stepped up. They also agreed in principle to hold a further meeting during the first half of 1983 but emphasized the need to decide the Agenda a year in advance in order to allow sufficient time for the compilation and drafting of national contributions.

RAW MATERIAL REQUIREMENTS OF THE NATO COUNTRIES AND OF THE SOVIET UNION, DEGREES OF SELF-SUFFICIENCY AND INTERNATIONAL REPERCUSSIONS OF THESE REQUIREMENTS

I. THE DEPENDENCE AND VULNERABILITY OF NATO COUNTRIES FOR THEIR SUPPLIES OF RAW MATERIAL

1. The reinforced meeting of the Economic Committee has reviewed the dependence and vulnerability of NATO countries for their supplies of certain **strategic materials(1).**

2. For this purpose, the figures for world output of these commodities were brought up to date, the range of products surveyed(2) was extended and the earlier conclusions concerning the degree of dependence on outside sources and the vulnerability of NATO in this field were refined. Lastly, practical measures to reduce this vulnerability were re-examined (particularly stockpiling).

A. Reliance on outside sources and vulnerability

3. Vulnerability is the result of dependence on outside sources, but it may vary in degree according to the world market situation for the commodity concerned which in turn is determined by general factors such as economic recession - or, again, factors peculiar to specific raw materials.

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(1) **Strategic raw materials are those essential to** civil and military production which have few or no substitutes and are not produced (at least in sufficient quantity) by the members of the Alliance as a whole; in addition, reserves - and consequently production - are concentrated in a limited number of third countries, and there is little diversification of NATO import sources, a situation which could affect security of supply in the event of political, economic or social disturbances in these countries.

(2) At the first exploratory reinforced meeting of the Economic Committee (15th and 16th November 1979), seven critical strategic raw materials were considered, namely: asbestos, cobalt, chromium, manganese, metals of the platinum group, vanadium and titanium. The latest meeting added five new products - niobium, tantalum, tin, tungsten and antimony.

(i) Reliance on outside sources

4. The last reinforced meeting of the Economic Committee generally confirmed and extended to other commodities the earlier conclusions on the virtually total dependence of NATO countries on outside sources for the materials in question. The share in NATO countries in world output is as follows(1).

For raw materials surveyed earlier:

- cobalt (Canada: between 3.2 and 4.9%;
  New Caledonia: between 1.1% and 4.4%)(2)
- chromium (Turkey: 7.1%; Greece: 0.3%)
- manganese (Turkey: 0.2%)
- metals in the platinum group (Canada: 2.8%)
- vanadium (US: 17.3%(3); Norway: 3.0%)
- rutile (nil)
- ilmenite (Norway: 14.6% United States: 13.8%;
  Canada: 13.2%)
- asbestos (Canada: 28.4%; United States: 1.8%;
  Turkey: 0.2%)(4)

For the new raw materials surveyed:

- niobium (Canada: 16.4%)
- tantalum (Canada: 15.9%)
- tin (United Kingdom: 1.0%)
- tungsten (United States: 6.1%; Canada: 5.5%;
  Turkey: 3.1%; Portugal: 2.4%; France: 1.0%)
- antimony (Canada: 4.6%; Turkey: 3.0%; Italy: 1.5%;
  United States: 1.0%).

(1) See Annex I: World ouput of 12 metals or ores.
(2) The figures provided by the experts differ and the producer countries will provide more precise figures later.
(3) Around 60% of United States national consumption.
(4) The NATO countries produce only chrysotile. The two other main categories of asbestos (amosite and crocidolite) are produced only by South Africa.

5. This situation gives cause for concern bearing in mind that the deposits occur mainly in a few third countries with the result that NATO countries are generally dependent on a limited number of suppliers.

6. As for the commodities surveyed earlier, reference is made to the importance of Central Africa, particularly Zaire and Zambia, which account for nearly 60% of world cobalt output, and of South Africa, which has a monopoly for the two main categories of asbestos (amosite and blue asbestos) and which generally supplies between 40 and 60% of Western chromium, manganese, platinum and vanadium.

7. The Soviet Union is also a major supplier, although significant changes have been noted. Whereas in the last few years it covered a substantial proportion of Western Europe's titanium requirements exports diminished and then stopped completely in 1980. At present the Russians are seeking to re-enter the world market(1). For platinum group metals(2), the Soviet Union is the second biggest supplier to the NATO countries covering between 20 and 25% of their requirements. Soviet exports could increase greatly between now and 1985 through the expansion of the capacity of the main treatment plant in Norilsk which would increase output of platinum to 4.5 million ounces by that time (and perhaps to 5 million in 1990). This potential increase in Soviet exports is important inasmuch as it would be able to cover the future increase in Western consumption and overcome South Africa's monopoly. Notwithstanding a 50% slump in its sales of chromium to the West within the last ten years, the USSR is still the second most important supplier to NATO as a whole (some 20% of Western requirements(3)). This fall results from the exhaustion of

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(1) See paragraphs 12,13 and 14 below.
(2) Soviet output comprises 3 times more palladium than platinum and comes mainly from copper and nickel processed at Norilsk (in Northern Siberia on the lower reaches of the Yenisey).
(3) The drop for France was even more noticeable, from 30% of all imports in 1970 to 5% at present. For the United States, the same figures are at 40% and 10% respectively.

certain surface deposits and by delays occurring in the opening up of new underground reserves. The prospects for Soviet deliveries of chrome iron ore in the 1980s are uncertain mainly because of technical innovations which have proved detrimental in the use of high-content and relatively more expensive Soviet chrome ores as well as the Soviet wish to gradually convert their chrome iron ore into ferrochrome themselves.

8. As regards the new commodities surveyed, production is again highly concentrated in a few producer countries outside the NATO grouping(1):

- niobium (Brazil: 80.4% of world output)
- tantalum (Thailand, Malaysia, Nigeria, Australia, Brazil: 72% altogether)
- tin (Malaysia, Thailand, Indonesia, Bolivia, USSR, China: 80% altogether)
- tungsten (China, USSR, Bolivia, South Korea, North Korea, Thailand: 61% altogether)
- antimony (Bolivia, South Africa, China, USSR: 66% altogether).

(ii) <u>World market position of raw materials under study</u>

9. <u>By and large</u>, there has been a noticeable improvement in the market position of the raw materials surveyed not only because of the effects of the economic crisis, but also as a result of the establishment before the crisis of new mining capacity for certain raw materials in various countries. There appears to be no need to implement emergency prospection programmes since the chances are fairly good of locating new deposits to replace those exhausted and satisfy a future increase in requirements. Nevertheless, where the funding of the future operating projects is concerned, the experts raised the question whether it would still be possible in future to find sufficient funds for the implementation of major mining projects and they proposed that this should be one of the subjects to be considered at a forthcoming meeting with raw material experts. Moreover,

(1) See Annex I

in the present political and military context the Soviet Union seems to be a "reliable" trading partner and is not seeking to cut off the West from its external sources of supply. All in all, there would seem to be no serious medium-term NATO supply problem provided that there are no serious political and military developments, either of a general or regional nature.

10. Furthermore, a more detailed examination was made of two raw materials - cobalt and titanium - for which fears of supply difficulties had been expressed earlier. In the case of cobalt, the "SHABA" crisis in 1978 gravely disrupted the market, but if the situation threatened to become critical, it never reached the danger-point nor led to an interruption in Western supplies. Since then, the situation has re-established itself through the play of market forces. For one thing, output resumed fairly rapidly and even increased in Zaire since 1978(1) and secondly the brisk price hike led to an increase in production and a drop in demand. Zambian output doubled between 1978 and 1980(2) and new production capacity has come on stream or is planned in Finland, the United States, Australia, Mexico, South Africa(3), New Caledonia, Canada and Cuba(4). At the same time, demand has fallen off because of large-scale substitutions and recyclings especailly where electrical applications are concerned (magnets). Owing to the economic recession, among other things, consumption of cobalt fell from 24,000 tonnes in 1979 to 20,000 tonnes in 1980 and since output in that same year was 24,250 tonnes, there is a large surplus production capacity.

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(1) Approximately 13,000 tonnes in 1978 and 1979 compared with 10,200 tonnes in 1977.
(2) There are plans to increase it further and perhaps double it in 1984.
(3) The bulk of South African production thus far has come from the platinum mines but research is presently being conducted for the extraction of cobalt from nickel, gold and uranium ore as well.
(4) In the context of the 1980-1985 plan, Cuba aims to increase its nickel output from 40,000 to 107,000 tonnes thereby enabling it to produce some 10,000 tonnes of cobalt for delivery to the Soviet Union which would become independent of the world market where it obtains some 1,000 tonnes a year.

Furthermore, there are sizable stocks not only with the producers(1) but with users who have built up emergency reserves. However, this current surplus in cobalt has pressed down prices significantly and pushed the users to reduce their stocks of cobalt in the belief that the drop in price and demand would continue(2). All in all, Allied supplies of cobalt, which looked precarious in November 1978, today seem secure in the short and medium term provided no serious and lasting political and economic crisis breaks out in Central Africa (i.e. in both Zaire and Zambia).

11. As regards cobalt extraction from polymetallic marine nodules, countries agreed that while the technical problems had largely been, or were on the way to being resolved, operations were being put off to 1990(3) and beyond for legal and economic reasons(4).

12. Of all the raw materials under study titanium is the one posing the least problem since the ore is found in abundance and the only problem in peacetime concerns the industrial production of titanium sponge. In the past, the Soviet Union - which produced half of these sponges - was the West's major supplier. However, its sales declined after 1975 and stopped in 1980. Under these conditions the limited supply lead to a doubling of prices, which in the West, involved the full utilization of available production capacity and the further establishment of new ones.

13. In total, annual Western output had developed as follows:

(1) At end-1980, stocks held by Zaire and Zambia were estimated respectively at 6,000 and 1,200 tonnes. Since then they have again greatly increased and in June 1981 stood at 14,000 tonnes for Zaire alone.
(2) The official price of cobalt, which rose to $25 a pound at the end of 1980, did not reach more than $12.5 a pound at the beginning of 1982.
(3) Some experts consider that deep sea mining will probably not contribute much to cobalt production until the late 1990s.
(4) Since cobalt is a sub-product of copper and nickel, its cost-effectiveness will depend to a great extent on the trend in the world nickel market whose requirements are at present covered by land-based reserves.

- Japan: 11,000 tonnes in 1978; 19,000 tonnes in 1980; plans for 26,000 tonnes;

- United States: 22,000 tonnes in 1978; 23,000 tonnes in 1980 (i.e. 80/90% of national consumption); possibility of 25,000 tonnes in 1981;

- United Kingdom: 4,000 tonnes in 1978; it has been decided to build a plant with a capacity of 5,000 tonnes, present output covers national consumption.

14. In line with the recession in the iron and steel industry the world's titanium market is at present sluggish. However, Soviet production, which is estimated at 55,000 tonnes, would seem excessive and may constitute a real danger of over-production in that country. At the beginning of 1981, the USSR offered small quantities of sponge on the world market at prices 50% below that of the asking price two years previously. If the USSR were to make a complete return to the market, there is a risk that the latter might deteriorate and that a new dependence among Western countries on the Soviet Union for a raw material vital for their armaments might develop. Consequently, it is essential that Western titanium production (including that of Japan) should not follow the fluctuating requirements of the USSR but remain at a level sufficient to cover Western consumption.

B. Practical Measures for reducing the vulnerability of the NATO countries in their supplies of certain raw materials

15. The stockpiling of strategic and critical raw materials by consumer countries is one of the most effective ways of coping with interruptions in supplies. Several countries - which had already defined their policy in this field at the previous meeting (November 1979) - provided additional details on developments since then. The United States holds stocks of 93 different commodities worth an estimated $15 billion. These stocks have been built up to cover essential industrial and civilian needs in wartime on the assumption that the conflict in question would be a conventional war on two fronts over a period of three years (plus one year's mobilization). However, in the light of changes in requirements, techniques and markets, it became apparent that the composition of the reserves should be extensively reorganized,

for the first time in 20 years, in order to meet the objectives. In March 1981 the United States Authorities announced the launching of a stock reconversion plan to be spread over five years. The first phase comprises a programme for the procurement of raw materials in the amount of $100,000,000 together with purchases financed from the proceeds of sales of surplus stock exceeding actual requirements. The raw materials to be procured include cobalt(1) and other priority materials to be chosen from a list drawn up by the Federal Emergency Management Agency(2). Since these are mostly sensitive raw materials purchases will be made in small quantities and when prices are lowest so as to promote market stability. The United States authorities will issue periodic statements on their procurement programmes. Furthermore, the experts pointed out that the stocks could only be used if the appropriate authorities declared a state of emergency which could come about if there were an interruption in raw material supplies leading to a shortage detrimental to national defence.

16. Budget appropriations of 240 million francs allocated by France in 1975 made it possible to build up a preliminary "national emergency reserve" to safeguard supplies of raw materials and supplement private stocks. However, this reserve (the present value of which amounts to F.fr 500 million) was found to be inadequate in 1980 and the authorities decided to speed-up their stockpiling with the aim of achieving coverage of two months average consumption by 1985 at a cost of around F.fr 5 billion. For this purpose the "French Raw Materials Fund" was set up in 1980; this is a public institution composed of representatives from various ministeries and is responsible for taking decisions on stockpiling and for rasing the necessary funds on the money markets. Purchases are made by a professional body the "Metal Imports Group" which for 1980/81 has already committed F.fr 1.6 billion for a first procurement slice.

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(1) The volume of cobalt procured will be at least 1.2 million pounds.

(2) Comprising the following metals or minerals: aluminium oxide, calcined bauxite, cobalt, niobium, fluorspar, manganesedioxide, nickel, metals in the platinum group, tantalum, titanium (including rutile) and vanadium.

17. While the ultimate purpose of the stockpiling programme is to provide for two months' average consumption, the variety and volume of the raw materials stored is determined in the light of their vulnerability (varying according to time) in industrial, economic and political terms. Industrially, it is necessary to provide continuity for all stages of production. Economically, consideration is given to requirements, origin and the distribution of production sources. Lastly, the "political" risk of the different producer countries is assessed. Since these reserves are designed to supplement private stocks in the event of supply difficulties, their composition will not be divulged so as not to influence commercial policy in this field. In any event, if private stocks are added to national stocks plus raw materials aboard ships, in ports or in the production line it is believed that national requirements for six months could be covered.

18. The UK position is that stockpiling is still being considered and that no decisions have been taken. The Government is exploring ways of involving the private sector in a possible stockpiling system thus minimising Government financial involvement. In parallel with a possible stockpile, which is viewed as a short-term response to the threat of supply interruption, the UK has been studying ways of improving UK security of mineral supply in the longer term, e.g. the scope for diversifying supply sources of minerals exhibiting marked concentration in production and uneveness in resource distribution. No decisions have yet been taken.

19. Canada has no stockpiles except for uranium, but consideration is now being given as to what raw materials might in fact be stockpiled. So far these studies have considered chromium, manganese and zirconium and they will be followed later by examinations of bauxite, alumina, fluorspar, bentonite, industrial diamonds, phosphate and tin.

20. The position of the Federal Republic of Germany is that stockpiling should not be a State undertaking but solely that of the private sector, which is responsible for safeguarding its own supplies. Germany also considers that it is more important to diversify mineral supply sources and practise a bilateral and multilateral policy designed to stabilize and assist countries producing raw materials.

21. The experts also referred in broad general terms to other ways of reducing NATO's vulnerability where strategic raw materials are concerned. They recommended the implementation or stepping up of certain practical measures such as prospection at home or in other areas, geographical diversification of imports, the speeding up (mainly by exchanges of information between countries) of technical progress to find substitutes for, recover or recycle the raw materials concerned and greater co-operation between countries to prevent local and shortages occurring in the event of crisis. However, certain experts emphasized that these means were not always adequate for responding quickly to a supply crisis because of the "time" factor. The opening up of new deposits generally required between seven and ten years, mining output was relatively in elastic and reconversion by means of substitution often caused delays prejudicial to defence programmes.

22. In the case of private stocks, the experts pointed out that the users certainly retained large-scale stocks, but that virtually none of the member countries could provide precise figures in this respect. They also referred to current efforts to build up stocks of strategic raw materials for purely speculative reasons. This should be looked at carefully in order to determine whether such stocks were an advantage for the supply of the Alliance or whether on the other hand they were not a danger because they pushed up prices and led to shortages. This could be the subject of a forthcoming meeting of experts on raw materials.

C. Position of certain major mineral-producing countries

23. A report on Zaire was submitted under this item of the Agenda(1). Zaire was depicted as one of the richest countries in the world for mineral resources. It leads in the extraction of cobalt, industrial diamonds and germanium and possesses more than half the world's reserves of tantalum. Because of its key position among mineral raw material producing countries, it was felt that Zaire deserved special attention. Moreover there was general agreement that it would be worthwhile to prepare studies on other important Third World mineral producing countries.

(1) "The importance of the Republic of Zaire for raw materials." Document AC/127-D/673. (Report presented by the German Delegation).

II. SOVIET RELIANCE ON OUTSIDE SOURCES OF RAW MATERIALS AND SOVIET TRANSACTIONS ON THE RAW MATERIAL MARKETS

A. Summary of Soviet industrial raw materials supply situation

(i) General remarks

24. The Soviet Union's plentiful reserves of a large range of products make it one of the world's leading producers of metals and non-metallic minerals(1). However, in spite of this overall favourable situation there has been a tendency in recent years for the USSR to reduce its exports and even, in several cases, to increase its imports of certain raw materials essential for an industrialized economy. There has also been an increase in the small number of ores for which the Russians depend on outside supply sources.

25. The Soviet Union finds it difficult, and in some cases impossible, to adapt production to increased demand for various reasons, the relative importance of which is difficult to determine. But one main reason would seem to be the exhaustion of the most easily workable reserves under present technical conditions and at the same time the increase in the cost of opening up new deposits. The higher costs are explained mainly by a drop in the metal content of certain ores in the traditional European Russian mining areas and the Southern Asian areas as well as by the shifting of supply sources to remote and inhospitable regions lacking adequate infrastructure. To these natural difficulties should be added the lack of capital to provide sufficient investment. A further major impediment increasingly affecting the Soviet mining industry is the shortage of manpower, particularly of specialised workers and boring and mining engineers in the Siberian mining areas.

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(1) An illustration of the Soviet Union's preponderant position as a producer of raw materials was given in the specialized review "Annales des Mines" (Paris, November-December 1980) which estimated that in 1978 the value of total Soviet mining output of the 45 main non-energy products was the highest in the world with 21% of the overall value of world output for these products.

26. Another possible explanation is that the Russians are establishing or increasing stockpiles. The fact that a certain metal is being imported does not necessarily signify that domestic production is unable to meet actual industrial consumption. However, for certain metals it is possible that there has been a change in the Soviet consumption pattern leading to an increase in requirements(1). The hypothesis that this could be an effort to conserve reserves appears rather doubtful and would only be fully justified if the reserves were easy to work, which is apparently not the case.

27. Several official statements and the emphasis placed on raw materials at the last Party Congress illustrate that the authorities are aware of the importance of the problem and that they may also be surprised by the sometimes unfavourable development in certain sectors of the country's extraction industry. Faced with this development, the USSR has shown a certain ability to adapt. They have easily and rapidly modified earlier orientations as defined by developments in a sector by importing metals instead of opening up new deposits. Projects for production capacity remain unfinished, or are postponed to a later date, since they are considered far too expensive compared with procurement possibilities on the world market.

28. The Soviet Union is making a big effort to reduce the industrial consumption of raw materials and to promote their more rational use. An example of these efforts is the recent setting-up on 4th October 1981 of an inter-administrative board for problems in the economizing of raw materials; this board is responsible on one hand for co-ordinating the work of Ministries and services concerned with the improved use of raw materials

(1) Little is known about the Soviet consumption pattern for certain metals (tungsten or titanium, for instance) and how it may compare with that of other industrialized economies. At the meeting of the Economic Committee on 26th and 27th March 1981, it was proposed that the question should be studied in future and included on the Agenda for the next meeting of experts on raw materials.

(and energy products) and on the other for monitoring the implementation of the measures taken in this field. Among other administrative steps designed to save on raw materials (and energy) mention should be made of the introduction of a system of penalties for enterprises which consume too much and one of bonuses for those which make savings(1). However, so far, it has not been possible to reduce Soviet raw material consumption per unit produced.

(ii) Degree of Soviet dependence on outside sources for the main raw materials of which it is a net importer.

29. The last survey of the Economic Committee (established on the basis of the situation as it appeared between 1977 and 1979)(2) showed that the commodities with the most important industrial and/or strategic applications of which the Soviet Union was a net importer are the raw materials of aluminium, cobalt, tin, molybdenum, tungsten, lead, since and fluorspar. Expressed as a percentage of apparent consumption(3), Soviet dependence on outside sources appears high (in the order of 25% or more) for all these eight metals and minerals, except for lead and zinc, for which it is no higher than 10%.

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(1) In this connection see:
- the note by the Delegation of the Federal Republic of Germany issued on 5th October 1981 under the title "Measures to save energy and raw materials in the Soviet Union."
- the note circulated by the French Delegation on 30th October 1981 entitled "URSS: Création d'une Commission inter-administrative pour les questions d'économie de matières premières."

(2) C-M(80)35 dated 7th July 1980.

(3) In the absence of information on Soviet stock movements, apparent consumption is defined as the algebraic sum of domestic production and net imports.

30. Known trends of Soviet raw materials trade in 1980 would seem to show that imports of the commodities mentioned above have remained roughly the same as during the two preceding years. This apparent stabilization of the volume of procurements is probably due above all to the slackening in 1979 and 1980 of Soviet industrial production growth(1) which was accompanied by an equally smaller increase in the raw material required. Consequently, in 1980, the degree of the USSR's dependence on outside sources changed little(2)(3).

31. As regards the detailed breakdown by commodity of Soviet dependence, its trends and its implications for that country, the meeting of the Economic Committee on 26th and 27th March 1981 largely confirmed the main conclusions set out in the Committee's previous study (e.g. Annex II to C-M(80)35). Consequently, the present report is confined to a brief summary of these conclusions and to highlighting the additional analyses contributed by the experts at that same meeting.

32. Soviet dependence on outside sources for the raw materials of aluminium (bauxite - alumina) has reached about one third of its apparent consumption. This has been the situation for a long time and is likely to become even more so because of the depletion of certain bauxite deposits and the poor prospects of increasing the relative share of production based on ores other than bauxite(4). Aware of the impossibility of becoming self-sufficient, the Soviet Union has concluded a series of long-term agreements with quite a few countries for the supply of bauxite or alumina which should provide a measure of stability and allow some diversification in foreign supply sources.

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(1) Soviet industrial production growth was: 1977: +5.7%; 1978: +4.8%; 1979: +3.4%; 1980: +3.6%.

(2) Molybdeneum would however seem to be an exception (see paragraph 35 below).

(3) In addition to the products specifically dealt with in this survey it should be remembered that the Soviet Union is a net importer of steel and iron goods (US$ 1.5 billion in 1980) and that there is little likelihood of this situation changing in the future.

(4) The success of the Soviet programme to develop substitutes for bauxite have been somewhat moderate; in spite of several setbacks (e.g. the use of nepheline from Azerbaijan) these substitutes have made it possible to cover approximately one third of aluminium ouput, although this figure appears to have reached its maximum.

33. For a number of years now the Soviet Union has also been a net importer of tin. The degree of dependence on outside sources has become stabilized at around 25-30% of apparent consumption and will probably remain at this level for the foreseeable future. Tin provides a good example of a situation where the Soviet Union possesses vast reserves in theory but is faced with difficulties and high operating costs because of the inaccessibility of such deposits. The 1980 trend in the pattern of Soviet procurements would seem to confirm the growing proportion of such purchases which are made though the agency of British metal dealers. Deliveries direct from Bolivia and Malaysia apparently make up the rest of Soviet imports.

34. There is no doubt that the Soviet Union is in a dependent position for cobalt. But the degree of dependence is difficult to gauge because of the disparity in estimates of Soviet domestic output(1). Another missing factor is the development of consumption, for it may be that the USSR, like the Western industrialized countries(2), has made an effort to find substitutes and recycle metal although the results of any work in this field are not known. By 1985 to 1990 the country will probably be self-sufficient thanks to increased production resulting from the opening of the Norilsk Siberian refining complex.

35. Since the early 1970s, Soviet output of molybdenum has increasingly failed to keep up with the growth in domestic demand(3), whereas in 1970 the Soviet Union could still cover its own requirements for this product, in 1975 imports accounted for 9% of apparent consumption, in 1978 for 30% and in 1980 for 54%(4). During the next few years, Soviet output from existing deposits in the Caucases and Eastern Siberia may expand slightly but not sufficiently to enable a return to self-sufficiency.

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(1) Estimates of Soviet output in 1980 vary from 2,000 to 6,000 metallic tonnes. On the basis of a volume of net imports estimated at around 1,500 metallic tonnes, including 800 tonnes obtained from treating nickel/cobalt oxide obtained from Cuba, the degree of Soviet dependence fluctuates between 20 and 43% of apparent consumption.
(2) See paragraph 10 above.
(3) The increased requirements are explained mainly by the use of this metal in the production of special steels and large diameter pipes.
(4) These percentages are for imports made through Western markets which cover the bulk of Soviet purchases.

However, the degree of Soviet dependence on outside sources may become slightly less than it is now.

36. Seen in this light, the opening up of the large copper/molybdenum deposits at Erdenet in Mongolia is of fundamental importance to the Soviet Union because this should provide a very secure supply source. According to available information, the resources made available by the Soviets for the development of this project are very large and the plans for its implementation have been almost completely fulfilled two years ahead of the original forecasts. Information, which would make it possible to assess the quality of the Erdenet ore, is not available.

37. The Soviet Union relies on outside supply sources for a high proportion (around 60%) of its apparent consumption of tungsten. For many years now the USSR has imported large quantities of this metal. However, the geographical pattern of its procurements has evolved markedly over the years; prior to 1960 China was the main supplier but its share has now greatly decreased in favour of other suppliers (Bolivia, Thailand) and, above all, the Western metal markets.

38. In the foreseeable future, Soviet dependence on outside sources will remain comparatively high in terms of apparent consumption. The possibility of a significant increase in output would appear doubtful because the opening up of new reserves will probably only compensate for the closing down of old mines. In the same way as for gold, which is also mined extensively in the Magadan Oblast, the USSR may find themselves faced with a drop in the metal content of their tungsten deposits. And since there seems to have been less research conducted into tungsten substitutes than in the West it is probable that they will be at a disadvantage in relation to the industrialized Western economies(1)(2).

(1) It should also be remembered that in any case substitutes for tungsten, when technically feasible, are sometimes limited in the USSR by inadequate ouput of certain metals which can be used as a substitute (molybdenum for example).

(2) At the meeting of the Economic Committee on 26th and 27th March 1981, the experts specifically emphasized the inadequacy of information concerning the pattern of Soviet tungsten consumption and, consequently, the importance of obtaining information on this point from the appropriate services.

39. The USSR has entered a period of dependence on foreign lead and zinc suppliers. The degree of dependence is limited however both for lead (where net imports account for 10% of apparent consumption) and, above all, for zinc (where the corresponding percentage is only 2%)(1). The fact that Moscow is now a net importer of these two metals is largely the result of delays in the opening up of new deposits. On the other hand, by 1990 the USSR should be able to provide for a sizeable expansion of output which may enable it to recover its self-sufficiency.

40. As regards fluorspar, the volume of Soviet output has shown a tendency for several years to remain constant in spite of the high priority given by the authorities to the development of its extraction. At present, domestic resources barely meet requirements. In the medium term, Soviet dependence will in all likelihood persist to a high degree because of the limited possibilities of expanding production and because the industrial uses of fluorspar make a decrease in its demand highly improbable. Furthermore, technical progress achieved so far can apparently not provide for economically satisfactory replacement processes(2). However, Soviet supply vulnerability is greatly reduced by the very major rôle played by Mongolia as a producer(3).

B. Steps taken by the Soviet Union to secure supplies of certain industrial raw materials

(i) Information on Soviet stockpiling policy

41. Certain information tends to indicate that the supply of products for stockpiling is being given priority by the Soviet authorities. Nevertheless, very little information is available on the stocks themselves. Incomplete information suggests the existence of stocks of certain specific commodities such as nickel, of which there are apparently large stocks, and titanium(4). Furthermore, after the event and over fairly long periods, it is possible to monitor certain stock movements from the USSR's approximate known production capacity and the volume of its sales on world markets. Such comparisons show, for instance,

(1) Estimates of the situation in 1980.
(2) On the other hand there are increasing possibilities for the recycling of fluorides for certain uses (aluminium production).
(3) Mongolia reportedly provides some 70% of Soviet fluorspar imports.
(4) Soviet stocks of titanium are probably made up of ore, sponge and semi-finished products.

that during the 1970s there were several phases during which the USSR reconstituted stocks which had been used previously. Such is the case for gold and platinum.

42. Not only is little information available on existing Soviet stocks, but little progress has been made in analysing Soviet stockpiling policy. It is particularly hard to identify the criteria adopted by the Soviet Union in selecting raw materials for stockpiling or in defining the meaning of minimum stocks.

(ii) Soviet transactions on the free markets

43. The Soviet Union is an active purchaser on the Western metals markets(1). In this way, it can effect the flexible and timely procurement of what is sometimes a high proportion (particularly in the case of tin, molybdenum and tungsten) of its import requirements. By and large, it would seem that Soviet transactions are based on a thorough knowledge of the workings of the markets. In 1980 such transactions made it clear once again that the Soviet Union does not have a disruptive effect on these markets whether by virtue of the volume of its dealings or their timing.

(iii) Soviet attitude as reflected in international raw material agreements

44. The experts generally confirmed the earlier conclusion reached in the Economic Committee's previous report(2), namely that while the Soviet Union had taken part in certain cases in negotiations (while naturally attempting to manoeuvre them a manner conducive to its interests) at a later stage it had not helped to implement the agreements. Typical of this attitude is their approach to the International Lead/Zinc Study Group for which the Soviets provides no statistics. The USSR's main purpose in taking part in such study groups is to obtain additional information on the present and likely future state of the world market or on technical matters.

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(1) The USSR is also a seller of certain metals.
(2) e.g. C-M(80)35, paragarphs 22 and 23.

45. In regard to the development of sea-bed resources and the position adopted by the USSR at the Law of the Sea Conference, it would seem that at present the Soviets have no wish to take part in sea-bed exploitation but would like to keep the possibility open for the future. With this in view, they seek to prevent the industrialized Western countries from exploiting large sea-bed zones by taking a position favourable to the developing countries on many issues in the framework of the Conference.

(iv) Soviet economic and technical relations with certain Third World raw material producing countries

46. There is nothing new about the technical and commercial agreements concluded between the Soviet Union and Third World countries; since 1958 in the non-ferrous metal sector there have been agreements on 72 projects in 44 countries(1). In the majority of cases Soviet participation consists in prospection and the delimitation of deposits of only regional significance. On the other hand, agreemnts which commit developing countires to deliver raw materials in exchange for technical assistance are few and limited to a small range of ores for which the USSR is dependent on foreign supply sources(2).

47. In the case of the last type of agreement, most ran transactions at present concern the raw materials of aluminium. The most important project by far of this type is the one with Guinea and which concerns deliveries of bauxite; it is the only one which is relatively important in terms of overall Soviet consumption of a specific metal(3). There is also a current Soviet project with Bolivia for tin (construction of volatilization plant) but there is no information as to whether the metal deliveries now being made are linked with this agreement or not. The Soviets are also engaged in developing the mining industry in the Congo and recive supplies of lead concentrate, but annual quantities (between 25,000 and 30,000 tonnes) are small compared with Soviet consumption. On the

(1) For the European COMECON grouping, the number of projects covered by agreements is 156. Annex III to this document lists these projects.
(2) The USSR also enters into agreements for deliveries of raw materials on a strictly commercial basis with no technical aid strings attached.
(3) Deliveries of bauxite through the "Office des Bauxites de Kinda" amounted in 1979 to 2 million tonnes or the equivalent of one fifth of total Soviet aluminium output (see AC/127-D/679 dated 8th April 1981).

other hand, nothing seems to have come of the 1978 agreement with Morocco concerning Soviet participation in the development of the Meskala phosphate deposits in exchange for deliveries of phosphate rock. As the project is behind schedule, it is unlikely that any phosphate will be dispatched before 1990.

48. To sum up, it seems that the USSR reaps modest advantages from its participation in Third World mining activities compared with the efforts it expends(1). With the exception of the Guinean bauxite - which is perhaps the one real success - the advantages would appear small against the investment and the number of experts seconded(2). The causes of what so far has been a relative failure are, among other things, faulty evaluations of deposits and a mistaken approach to mining operations as a whole (climate, transport facilities, difficult and limited contacts with the local populations). Moreover, the Soviet mining industry personnel sent to the developing countries are often professionally inadequate(3). It is also a fact that so far the activities of the Soviet Union have done little to meet the wishes of the developing countires in obtaining the transfer of technology which would make it possible to process their mineral resources on the spot.

49. As the situation now stands, Soviet activities in the Third World mining industries show no signs of conflicting with the economic interests of the members of the Alliance. The agreements concluded by the USSR which have led to the establishment of a flow of raw materials have a "marginal" impact on the market and are confined to a very small number of raw materials. Their procurement is apparently determined exclusively by economic considerations. Finally, it should be pointed out that according to the available information it would not seem that the Soviet Union is engaged in projects concerning metals of particular strategic importance (cobalt, chromium, manganese or platinum, for instance). Consequently, the argument sometimes advanced in

(1) In some respects the difficulties and errors encountered are those which earlier faced the Western countries.
(2) Some estimates put the number of Soviet experts working in the mining industry in Third World countries at 6,000.
(3) This may be because Moscow prefers to keep its more competent personnel for domestic prospection.

certain publications to the effect that the Western industrialized countries and the Communist bloc are already engaged in a phase of the struggle for Third World mineral resources is without foundation at present. Although we are not in the throes of this so-called "resources war", there is heightened competition between the Western and Communist countries for access to certain markets - and by the same token to certain raw materials - of the Third World.

WORLD MINING PRODUCTION FOR 12 METALS OR ORES:

ASBESTOS, MANGANESE, CHROMIUM, VANADIUM, ILMENITE, RUTILE, COBALT, PLATINUM GROUP METALS, NIOBIUM, TANTALUM, TUNGSTEN, TIN AND ANTIMONY.

PRODUCTION MINIERE MONDIALE DE 12 METAUX OU MINERAIS:

AMIANTE, MANGANESE, CHROME, VANADIUM, ILMENITE, RUTILE, COBALT, METAUX DU GROUPE PLATINE, NIOBIUM, TANTALE, TUNGSTENE, ETAIN ET ANTIMOINE.

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Statistics compiled by the "Bundesanstalt für Geowissenschaften und Rohstoffe" (BGR) at Hanover.

Sources: Selected national statistics, statistics from "Metallgesellschaft" (Frankfurt) and "Minerals Yearbook" (Washington).

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Statistiques compilées par la "Bundesanstalt für Geowissenschaften und Rohstoffe" (BGR) à Hanovre.

Sources: Diverses statistiques nationales, statistiques de la "Metallgesellschaft" (Francfort) et "Minerals Yearbook" (Washington).

ASBESTOS: Production frommines (1979) in 1000 metric tons (asbestos)
AMIANTE: Production des mines (1979) en 1000 tonnes métriques (amiante)

Country / Pays	Production	Total world / Monde entier		Western world / Monde occidental		Centr. plan. economies / Economies planifiées
	1 000 mt	%	% cumulative / % cumulatif	%	% cumulative / % cumulatif	%
1. USSR / URSS	2 470.0	46.7	46.7			90.8
2. Canada	1 501.0	28.4	75.1	58.5	58.5	
3. Zimbabwé	259.6	4.9	80.0	10.1	68.6	
4. P.R. China / R.P. Chine	250.0	4.7	84.7			9.2
5. South Africa / Afrique du Sud	249.2	4.7	89.5	9.7	78.3	
6. Italy / Italie	130.0	2.5	91.9	5.1	83.4	
7. Brazil / Brésil	120.0	2.3	94.2	4.7	88.0	
8. USA	93.4	1.8	96.0	3.6	91.7	
9. Australia / Australie	70.0	1.3	97.3	2.7	94.4	
10. Swaziland	38.0	0.7	98.0	1.5	95.9	
11. Cyprus / Chypre	36.0	0.7	98.7	1.4	97.3	
12. India / Inde	20.0	0.4	99.1	0.8	98.1	
13. South Korea / Corée du Sud	14.0	0.3	99.3	0.5	98.6	
14. Yugoslavia / Yougoslavie	10.5	0.2	99.5	0.4	99.0	
15. Turkey / Turquie	10.0	0.2	99.7	0.4	99.4	
CMEA/CAEM	2 470.5	46.7				90.8
P.R. China / R.P. Chine	250.0	4.7				9.2
Centrally planned economies / Economies planifiées	2 720.5	51.5				100.0
West. industrialized countries / Pays indust. occidentaux	2 062.1	39.0		80.3		
Developing countries / Pays en développement	504.7	9.5		19.7		
Western world / Monde occidental	2 566.8	48.5		100.0		
Total world / Monde entier	5 287.3	100.0				

MANGANESE: Production from mines in 1979 (partially processed commercial product)
Production des mines en 1979 (produit de commerce en partie traité)

Country / Pays	Production 1000 mt	Total world Monde entier %	Total world Monde entier % cumulative % cumulatif	Western world Monde occidental %	Western world Monde occidental % cumulative % cumulatif	Centr.plan.ecouomies Economies planifiées %
1. USSR / URSS	9 500.0	39.7	39.7			89.0
2. South Africa / Afrique du Sud	5 182.3	21.7	61.4	39.1	39.1	
3. Gabon	2 303.1	9.6	71.0	17.4	56.5	
4. India / Inde	1 691.0	7.1	78.1	12.8	69.3	
5. Australia / Australie	1 666.3	7.0	85.1	12.6	81.9	
6. Brazil / Brésil	1 209.8	5.1	90.1	9.1	91.0	
7. P.R. China / R.P. Chine	1 000.0	4.2	94.3			9.4
8. Ghana	525.2	2.2	96.5	4.0	95.0	
9. Mexico / Mexique	177.4	0.7	97.2	1.3	96.3	
10. Hungary / Hongrie	130.7	0.5	97.8			1.2
11. Morocco / Maroc	110.0	0.5	98.2	0.8	97.2	
12. Japan / Japon	88.3	0.4	98.6	0.7	97.8	
13. Argentinia / Argentine	53.0	0.2	98.8	0.4	98.2	
14. Bulgaria / Bulgarie	42.0	0.2	99.0			0.4
15. Turkey / Turquie	41.5	0.2	99.2	0.3	98.5	
CMEA / CAEM	9 672.7	40.5				90.6
P.R. China / R.P. Chine	1 000.0	4.2				9.4
Centrally planned economies / Economies planifiées	10 672.7	44.6				100.0
Western industrialized countr. / Pays industrial. occidentaux	7 005.7	29.3		52.9		
Developing countries / Pays en developpement	6 229.0	26.1		47.1		
Western world / Monde occident.	13 237.7	55.4		100.0		
Total world / Monde entier	23 910.4	100.0				

CHROMIUM: Production from mines (1979) in 1000 metric tons of ore(Chromite)
CHROME: Prouuction des mines (1979) en 1000 tonnes métriques de minerais (Chromite)

Country / Pays	Production 1000 mt	Total world / Monde entier %	% cumulative / % cumulatif	Western world / Monde occidental %	% cumulative / % cumulatif	Centrally plan.economies / Economies planifiées %
1. South Africa / Afrique du Sud	3 175.0	33.0	33.0	50.7	50.7	
2. USSR / URSS	2 400.0	25.0	58.0			71.9
3. Albania / Albanie	900.0	9.4	67.4			26.9
4. Turkey / Turquie	680.0	7.1	74.5	10.8	61.5	
5. Philippines	544.0	5.7	80.1	8.7	70.2	
6. Simbabwe	541.8	5.6	85.8	8.6	78.8	
7. Finland / Finlande	434.7	4.5	90.3	6.9	85.8	
8. India / Inde	321.0	3.3	93.6	5.1	90.9	
9. Brazil / Brésil	250.0	2.6	96.2	4.0	94.9	
10. Madagascar	128.3	1.3	97.6	2.0	96.9	
11. Iran	81.0	0.8	98.4	1.3	98.2	
12. Greece / Grèce	32.0	0.3	98.8	0.5	98.7	
13. Cuba	30.0	0.3	99.1			0.9
CMEA / CAEM	2.440.0	25.4				73.1
Albania	900.0	9.4				26.9
Centrally planned economies	3 340.0	34.8				100.0
Western indust. Countries / Pays indust. occidentaux	3 655.6	38.0		58.3		
Developing countries / Pays en developpement	2 612.1	27.2		41.7		
Western world / Monde occident.	6 267.7	65.2		100.0		
Total world / Monde entier	9 607.7	100.0				

(1) Selon les experts français, la production de la Nouvelle-Calédonie atteindrait 10.000 tonnes.

According to the French experts, the New Caledonian production would reach 10,000 tons.

VANADIUM: Production from mines (1979) in metric tons (metal content)

VANADIUM: Production des mines (1979) en tonnes métriques (métal contenu)

Country / Pays	Production	Total world / Monde entier		Western world / Monde occidental		Centrally plan.economies / Economies planifiées
	mt	%	% cumulative / % cumulatif	%	% cumulative / % cumulatif	%
1. South Africa / Afrique du S.	13 774	41.7	41.7	57.5	57.5	
2. USSR / URSS	9 072	27.5	69.2			100.0
3. USA	5 715	17.3	86.5	23.9	81.4	
4. Finland / Finlande	2 768	8.4	94.9	11.6	93.0	
5. Norway / Norvège	989	3.0	97.9	4.1	97.2	
6. Chile / Chili	680	2.1	100.0	2.8	100.0	
CMEA / CAEM	9 072	27.5				100.0
Centrally plan. economies / Economies planifiées	9 072	27.5				100.0
West. indust. countries / Pays indust. occidentaux	23 216	70.4		97.2		
Developing countries / Pays en développement	680	2.1		2.8		
West.world / Monde occidental	23 896	72.5		100.0		
Total world / Monde entier	32 968	100.0				

ILMENITE: Production from mines (1979) in metric tons (TiO_2 - content)
Production des mines en tonnes métriques (TiO_2 contenu)

Country / Pays	Production mt	Total world Monde entier %	Total world Monde entier % cumulative / % cumulatif	Western world Monde occidental %	Western world Monde occidental % cumulative / % cumulatif	Centr.plan.economies Econom. planifiées %
1. Australia / Australie	654 300	25.8	25.8	28.3	28.3	
2. Norway / Norvège	368 900	14.6	40.4	16.0	44.3	
3. USA	349 500	13.8	54.2	15.1	59.4	
4. Canada	333 900	13.2	67.4	14.4	73.8	
5. South Africa / Afrique du Sud	315 200	12.4	79.8	13.6	87.4	
6. USSR / URSS	220 400	8.7	88.5			100.0
7. Malaysia / Malaisie	102 600	4.1	92.6	4.4	91.9	
8. India / Inde	84 200	3.3	95.9	3.6	95.5	
9. Finland / Finlande	58 500	2.3	98.2	2.5	98.1	
10. Sri Lanka	37 100	1.5	99.7	1.6	99.7	
11. Brazil / Brésil	7 600	0.3	100.0	0.3	100.0	
CMEA / CAEM	220 400	8.7				100.0
Centrally plan. economies / Economies planifiées	220 400	8.7				100.0
West. indust. countries / Pays indust. occidentaux	2 080 500	82.2		90.0		
Developing countries / Pays en développement	231 500	9.1		10.0		
Western world / Monde occid.	2 312 000	91.3		100.0		
Total world / Monde entier	2 532 400	100.0				

RUTILE: Production from mines (1979) in metric tons (TiO_2 - content)
Production des mines (1979) en tonnes métriques (TiO_2 contenu)

Country / Pays	Production mt	Total world / Monde entier %	Total world / Monde entier % cumulative / % cumulatif	Western world / Monde occidental %	Western world / Monde occidental % cumulative / % cumulatif	Centrally plan.economies / Economies planifiées %
1. Australia / Australie	267 085	65.4	65.4	70.3	70.3	
2. Sierra Leone	51 840	12.7	78.1	13.6	84.0	
3. South Africa / Afrique du Sud	38 810	9.5	87.5	10.2	94.2	
4. USSR / URSS	28 740	7.0	94.6			100.0
5. Sri Lanka	13 300	3.3	97.8	3.5	97.7	
6. India / Inde	8 710	2.1	100.0	2.3	100.0	
CMEA / CAEM	28 740	7.0				100.0
Centrally planned economies / Economies planifiées	28 740	7.0				100.0
Western indust. countries / Pays indust. occidentaux	305 895	74.9		80.5		
Developing countries / Pays en développement	73 975	18.1		19.5		
Western world / Monde occidental	379 870	93.0		100.0		
Total world / Monde entier	408 610	100.0				

COBALT: Production from mines (1979) in metric tons (metal content)
Production des mines (1979) en tonnes métriques (métal contenu)

Country / Pays	Production mt	Total world Monde entier %	Total world Monde entier % cumulative / % cumulatif	Western world Monde occidental %	Western world Monde occidental % cumulative / % cumulatif	Centrally pln.economies Economies planifiées %
1. Zaire	13 155	46.3	46.3	53.1	53.1	
2. Australia / Australie	3 445	12.1	58.5	13.9	67.0	
3. Zambia / Zambie	2 720	9.6	68.0	11.0	78.0	
4. USSR / URSS	2 000 (1)	7.0	75.1			55.1
5. Cuba	1 630	5.7	80.8			44.9
6. New Caledonia / Nouvelle Calédonie	1.255(2)	4.3	85.2	5.0	83.0	
7. Philippines	1 090	3.8	89.0	4.4	87.4	
8. Finland / Finlande	1 035	3.6	92.6	4.2	91.6	
9. Canada	910(3)	3.2	95.8	3.7	95.2	
10. Morocco / Maroc	795	2.8	98.6	3.2	98.4	
11. Zimbabwe	205	0.7	99.4	0.8	99.3	
12. Botswana	180	0.6	100.0	0.7	100.0	
CMEA / CAEM	3 630	12.8				100.0
Centrally planned economies / Economies planifiées	3 630	12.8				100.0
Western industrialized countries / Pays indust. occidentaux	5 390	19.0		21.8		
Developing countries / Pays en développement	19 380	68.2		78.2		
Western world / Monde occidental	24 770	87.2		100.0		
Total world / Monde entier	28 400	100.0				

(1) Selon les estimations américaines, la production de l'Union Soviétique atteindrait actuellement environ 6.000/7.000 tonnes.
According to the American estimates, the production of the Soviet Union would actually reach about 6,000/7,000 tons.

(2) Selon les experts français, la production de la Nouvelle-Calédonie n'atteindrait, semble-t-il, que 300 tonnes.
According to the French experts, it appears that the production of New Caledonia would only reach 300 tons.

(3) Selon les experts canadiens, la production nationale s'élèverait à 1.400 tonnes.
According to the Canadian experts, the national production would reach 1,400 tons.

PLATINUM GROUP METALS: Production from mines (1979) in kg (metal content)
METAUX DU GROUPE PLATINE: Production des mines (1979) en kg (métal contenu)

Country / Pays	Production kg	Total world / Monde entier %	Total world / Monde entier % cumulative / % cumulatif	Western world / Monde occidental %	Western world / Monde occidental % cumulative / % cumulatif	Centrally plan.economies / Economies planifiées %
1. USSR / URSS	99 531.1	48.1	48.1			100.0
2. South Africa / Afrique du Sud	99 531.1	48.1	96.1	92.5	92.5	
3. Canada	5 754.1	2.8	98.9	5.3	97.8	
4. Japan / Japon	1 063.7	0.5	99.4	1.0	98.8	
5. Colombia / Colombie	466.6	0.2	99.6	0.4	99.3	
6. Australia / Australie	357.7	0.2	99.8	0.3	99.6	
7. USA	227.1	0.1	99.9	0.2	99.8	
CMEA / CAEM	99 531.1	48.1				100.0
Centrally plan. economies / Economies planifiées	99 531.1	48.1				100.0
Western indust. countries / Pays industrialisés occidentaux	107 133.4	51.7		99.6		
Developing countries / Pays en développement	469.7	0.2		0.4		
Western world / Monde occidental	107 603.1	51.9		100.0		
Total world / Monde entier	207 134.3	100.0				

NIOBIUM: Production from mines (1979) in metric tons (metal content)
NIOBIUM: Production des mines (1979) en tonnes métriques (métal contenu)

Country / Pays	Production mt	Western world / Monde occidental %	% cumulative / % cumulatif
1. Brazil / Brésil	8 287.1	80.4	80.4
2. Canada	1 690.1(1)	16.4	96.8
3. Nigeria	227.0	2.2	99.0
4. Australia / Australie	31.8	0.3	99.3
5. Rwanda / Ruanda	15.9	0.2	99.5
6. Thailand / Thaïlande	15.5	0.2	99.7
7. Malaysia / Malaisie	13.6	0.1	99.9
Western industrialized countries / Pays industrialisés occidentaux	1 723.3	16.7	
Developing countries / Pays en développement	8 580.5	83.3	
Western world / Monde occidental	10 303.8	100.0	

Production of centrally planned economies unknown

Production des pays à commerce d'état inconnue

(1) Selon les experts canadiens, la production nationale aurait atteint 2.512 tonnes en 1979 et 3.330 tonnes en 1980.

According to the Canadian experts, the national production would have reached 2,512 tons in 1979 and 3,330 tons in 1980.

ANNEXE I au/ANNEX I to
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TANTALUM: Production from mines (1978) in kg (metal content)
TANTALE: Production des mines (1978) en kg (métal contenu)

Country / Pays	Production kg	Western world / Monde occidental %	% cumulative / % cumultif
1. Thailand / Thailande	194 140	24.4	24.4
2. Malaysia / Malaisie	127 740	16.0	40.4
3. Canada	126 290	15.9	56.3
4. Nigeria	93 890	11.8	68.1
5. Australia / Australie	89 810	11.3	79.4
6. Brazil / Brésil	68 040	8.5	87.9
7. Mozambique	38 750	4.9	92.8
8. Zaire	34 640	4.4	97.2
9. Zimbabwe	11 000	1.4	98.6
10. Rwanda / Ruanda	9 500	1.2	99.8
11. Burundi	1 000	0.1	99.9
Western industrialized countries / Pays industrialisés occidentaux	216 820	27.2	
Developing Countries / Pays en Développement	579 250	72.8	
Western world / Monde occidental	796 070	100.0	

Production of centrally planned economies unknown

Production des pays à commerce d'état inconnue

TUNGSTEN: Production from mines (1979) in metric tons (metal content)
TUNGSTENE: Production des mines (1979) en tonnes métriques (métal contenu)

Country / Pays	Production	Total world / Monde entier		Western world / Monde occidental		Centrally planned economies / Economies planifiées
	mt	%	% cumulative / % cumulatif	%	% cumulative / % cumulatif	%
1. P.R. China / R.P.Chine	11.500	23.4	23.4			51.3
2. USSR / URSS	8.700	17.7	41.2			38.8
3. Australia / Australie	3.856	7.9	49.0	14.5	14.5	
4. Bolivia / Bolivie	3.175	6.5	55.5	11.9	26.4	
5. USA	2.994	6.1	61.6	11.2	37.7	
6. Canada	2.722	5.5	67.2	10.2	47.9	
7. South Korea / Corée du Sud	2.722	5.5	72.7	10.2	58.1	
8. North Korea / Corée du Nord	2.150	4.4	77.1			9.6
9. Thailand / Thailande	1.814	3.7	80.8	6.8	64.9	
10. Turkey / Turquie	1.542	3.1	83.9	5.8	70.7	
11. Austria / Autriche	1.361	2.8	86.7	5.1	75.8	
12. Brazil / Brésil	1.179	2.4	89.1	4.4	80.3	
13. Portugal	1.179	2.4	91.5	4.4	84.7	
14. Japan / Japon	760	1.5	93.1	2.9	87.5	
15. Burma / Birmanie	680	1.4	94.5	2.6	90.1	
16. Peru / Pérou	564	1.1	95.6	2.1	92.2	
17. France	500	1.0	96.6	1.9	94.1	
CMEA / CAEM	8.780	17.9				39.1
China and North Korea / Chine et Corée du Nord	13.650	27.8				60.9
Centrally planned economies / Economies planifiées	22.430	45.7				100.0
Western indust. countries / Pays indust. occidentaux	13.922	28.4		52.3		
Developing countries / Pays en développement	12.699	25.9		47.7		
Western world / Monde occident.	26.621	54.3		100.0		
Total world / Monde entier	49.051	100.0				

TIN: Production from mines (1979) in 1000 metric tons (metal content)
ETAIN: Production des mines (1979) en 1000 tonnes métriques (métal contenu)

Country / Pays	Production	Total world / Monde entier		Western world / Monde occidental		Centrplan.economies / Economies planifiées	
	1.000 mt	%	% cumulative / % cumulatif	%	% cumulative / % cumulatif	%	
1. Malaysia / Malaisie	63.0	26.6	26.6	31.5	31.5		
2. Thailand / Thailande	34.0	14.3	40.9	17.0	48.6		
3. Indonesia / Indonésie	29.4	12.4	53.3	14.7	63.3		
4. Bolivia / Bolivie	27.6	11.6	64.9	13.8	77.1		
5. UESR / URSS	18.0(1)	7.6	72.5			48.1	
6. P.R. China / R.P. Chine	17.0	7.2	79.7			45.3	
7. Australia / Australie	11.4	4.8	84.5	5.7	82.8		
8. Brazil / Brésil	7.0	3.0	87.5	3.5	86.3		
9. Zaire	3.5	1.5	88.9	1.8	88.1		
10. Nigeria	2.8	1.2	90.1	1.4	89.5		
11. South Africa / Afrique du Sud	2.7	1.1	91.3	1.4	90.8		
12. U.K. / Royaume-Uni	2.3	1.0	92.2	1.2	92.0		
13. German D.R. / R.D.A.	1.6	0.7	92.9			4.3	
CMEA / CAEM	19.8	8.3				52.9	
China and Laos / Chine et Laos	17.6	7.5				47.1	
Centrally plan. economies	37.4	15.8				100.0	
Western indust. countries / Pays indust. occidentaux	18.1	7.6		9.1			
Developing countries / Pays en développement	181.6	76.6		90.9			
Western world / Mond.occident.	199.7	84.2		100.0			
Total world / Monde entier	237.1	100.0					

(1) Selon les estimations du Royaume Uni la production soviétique aurait atteint 34.000 tonnes en 1979.
According to estimates of the United Kingdom, the production of the Soviet Union would reach 34,000 tons in 1979.

ANTIMONY: Production from mines (1979) in metric tons (metal content)
ANTIMOINE: Production des mines (1979 en tonnes métriques (métal contenu)

Country / Pays	Production mt	Total world / Monde entier %	Total world / Monde entier % cumulative / % cumulatif	Western world / Monde occidental %	Western world / Monde occidental % cumulative / % cumulatif	Centr.plan.economies / Economies planifiées %
1. Bolovia / Bolivie	13 019	20.4	20.4	28.4	28.4	
2. South Africa / Afrique du Sud	11 614	18.2	38.6	25.3	53.7	
3. P.R. China / R.P. Chine	10 000	15.7	54.3			53.9
4. USSR / URSS	7 300	11.8	66.1			41.9
5. Canada	2 954	4.6	70.7	6.4	60.1	
6. Thailand / Thaïlande	2 935	4.6	75.3	6.4	66.5	
7. Mexico / Mexique	2 872	4.5	79.8	6.3	72.8	
8. Yougoslavia / Yougoslavie	2 283	3.6	83.4	5.0	77.7	
9. Turkey / Turquie	1 890	3.0	86.3	4.1	81.9	
10. Australia / Australie	1 558	2.4	88.8	3.4	85.3	
11. Italy / Italie	948	1.5	90.3	2.1	87.3	
12. Morocco / Maroc	883	1.4	91.6	1.9	89.3	
13. Peru / Pérou	763	1.2	92.8	1.7	90.9	
14. Spain / Espagne	660	1.0	93.9	1.4	92.4	
15. USA	655	1.0	94.9	1.4	93.8	
16. Austria / Autriche	655	1.0	95.9	1.4	95.2	
17. Guatemala	620	1.0	96.9	1.4	96.2	
CMEA / CAEM	7 800	12.2				43.6
China and other centr.plan.econ. / Chine et d'autres économies plan.	10 100	15.9				56.4
Centrally planned economies / Economies planifiées	17 900	28.1				100.0
Western industrialized countries / Pays industrialisés occidentaux	21 327	33.4		46.5		
Developing countries / Pays en développement	24 562	38.5		53.5		
Western world / Monde occidental	45 889	71.9		100.0		
Total world / Monde entier	63 789	100.0				

DEPENDENCE OF NATO COUNTRIES ON OUTSIDE SOURCES: SURVEY OF NEW COMMODITIES

(i) NIOBIUM

1. Practically 80% of niobium supplies are used in the form of ferroniobium for the production of high tensile steel and certain super-alloys. The remainder is used for permanent magnets (18%) and as pure metal (3%). It has applications in the building industry, tools and stainless steel, oil pipelines and gas lines, drilling materials as well as in the aeronautical and motor industries.

2. Mining production is confined almost exclusively to Brazil (80.4% of world production in 1979) and Canada (16.4%). In recent years, Brazil converted its own ore into ferroniobium which led to competition with the processing firms in the consumer countries and a drop in prices. As a result, Brazil in 1980 resumed its exports of concentrates.

3. Despite its very heavy concentration in a single producer country, NATO supplies of niobium are not threatened by any monopolistic operation since in most of its applications niobium has competitive but variable substitutes depending on the use made of this raw material. Examples are vanadium, molybdenum, titanium, tungsten and tantalum.

(ii) TANTALUM

4. Tantalum comes either from mines worked exclusively for tantulum ore (Canada for example) or, more often than not, from niobium or tin mines where it is extracted at the same time (Thailand, Malaysia and Zaire). The producing countries export their product to the United States, the Federal Republic of Germany, Japan, Belgium and Austria, which are the only countries with metallurgical production capacity(1).

5. 95% of the tantalum is used as a metal or in alloys(2). Tantalum metal is corrosion-proof, hard, ductile and a good conductor. It is used for the coating of electrical condensers,

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(1) Canada exports most of its concentrates of tantalum to the U.S.

(2) The remainder is used in the mechanical engineering industry as tantalum carbide, an extremely hard product used in the manufacture of cutting tools.

chemical industry apparatus, surgical instruments as well as in the transport industry and for nuclear reactors. The main producers are Thailand (24.4% of mining production in 1979), Malaysia (16.0%), Canada (15.9%), Nigeria (11.8%) and Australia (11.3%).

6. The tantalum market has expanded greatly in the last few years, a situation which caused a rise in prices and a supply deficit (100/150 tons) which was covered by stocks. At present, the market is stabilising and balance is expected to be restored because of:

- the increased supply resulting from the discovery of new deposits; the tantalum reserves occur in Zaire (60%, whereas present production is only 5%), Nigeria, Brazil, Canada (Manitoba), Australia (big potential producer) and Egypt;

- the lower consumption in the chemical industry and electrical sectors (altogether some 75% of total consumption) thanks to technical advances which have made it possible to reduce the thickness of tantalum coatings for electrical and chemical equipment without any loss of effectiveness;

- the scope for substitution: it was already possible to replace tantalum by niobium in certain applications and it can now be replaced by titanium.

(iii) TIN

7. Tin is used chiefly for food cans (tinplate: 60% of consumption) and in soldering alloys (30%). The remainder is used in alloys (bronze) and in certain applications in the electronic and electrical sectors as a substitute for gold and silver. For tinplate, tin can be replaced by several substitutes (glass, aluminium, plastic, paper etc.) but not always as efficiently and cheaply. On the other hand, there is no satisfactory substitute for tin when used for welding as an alloy with lead. Recycling is good when tin is used for welding and tinplating in accordance with old techniques. However, for electrolytic tinning the coating of tin is much too thin to be recovered.

8. The NATO countries have virtually no tin mining capacity. Tin occurs in primary deposits - i.e. mines where tin ore (cassiterite) is found in hard rocks (underground mines in Bolivia for instance) - or in secondary deposits where the cassiterite occurs in old or existing alluvial deposits (placer deposits, opencast mines) or even on the coastal sea-bed. These secondary

deposits account for 65% of world output. They are strongly concentrated in South-East Asia(1) (Malaysia: 26.6%; Thailand: 14.3%; Indonesia: 12.4%; Bolivia: 11.6%(2); USSR: 7.6%(3); China: 7.2%(3); Australia: 4.8%(4)(5)). At present, the producer countries export practically no tin concentrates since they can themselves convert the raw material into metal.

(iv) TUNGSTEN

9. Tungsten is an extremely heavy and hard metal with good resistance to corrosion and high temperatures. It is used mainly (65% of consumption) as tungsten carbide which is one of the hardest substances used in the manufacture of cutting tools, mining and boring equipment and articles with good resistance to wear (motor industry). It is also used in the manufacture of high-speed steel and various alloys as well as in the electrical industry (filaments) and the chemical industry. Tungsten is also used in the military sector but consumption here is low compared with that of the civilian sector. A certain degree of substitution is technically possible depending on the tungsten application concerned (titanium, molybdenum, vanadium etc.) but it is generally not cost-effective and, moreover, when tungsten is used for its extremely heat-resistant qualities no substitution is possible.

10. The leading producers of tungsten are China (23.4%) and the USSR (17.7%), with, a long way behind them, Australia (7.9%), Bolivia (6.5%), the United States (6.1%), Canada and North Korea (5.5%) and Thailand (3.7%), the rest being provided by numerous countries (including Turkey and France) with an output of 3% or less. Since 1965 Western output has risen appreciably from 42% of world production in 1965 to 54% in 1979, thanks to the emergence of new producers, and now outstrips the production of the Communist countries. Although they must be treated with caution, the current figures for proven and probably reserves are China 46.9% of world reserves, Canada 12.0%, USSR 10.6%, North Korea and the United States 5.5%, with the rest shared among the small producers. If these reserves are examined by groups of countries, the Asian countries dominate with 52.5%, the industrialised countries (6) have approximately 25%, the developing countries around 12%, divided up among a large numer of countries, while the COMECON countries have virtually only the Russian reserves.

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(1) Only placer deposits
(2) Ore
(3) Only placer deposits
(4) Placer deposits and ore
(5) World reserves are plentiful and the market is at present slack
(6) Canada, United States, Australia, Turkey, Portugal, France, Japan, Spain and Austria

11. As for supplies, the main sources for the United States(1) are Canada, Bolivia and South Korea, while the EEC countries rely for 40% of their supplies on China, 11% on the USSR and 6% on North Korea(2).

(v) ANTIMONY

12. Antimony is employed solely as an alloy, whether as a metal to harden lead (car batteries)(3), or as a fire-proofing oxide in the plastics, textiles and rubber industries or as a pigment for paint or ceramics. However, the pattern of antimony consumption is presently in full transformation because of the increased use of antimony in oxide form (accelerated locally because of the implementation of fire protection legislation) and because antimony is used less as a lead hardener in accumulators where it is being replaced by calcium(4). Regarding the use of substitutes, this is easier when antimony is employed as an oxide, when mercury, lead and chromium can be used instead, but recycling is often impossible since the antimony is consumed. If antimony is used in car batteries, recycling can amount to as much as 50%.

13. The antimony deposits are always small and spread fairly widely over different countries: Bolivia (20.4%), South Africa (18.2%), China (15.7%), USSR (11.8%), Canada and Thailand (4.6%), Mexico (4.5%), Yugoslavia (3.0%), Turkey (2.4%) etc.(5). World reserves amount to 7,200,000 tonnes which occur mainly in China (530,000 tonnes), Bolivia (420,000 tonnes), South Africa and the USSR (300,000 tonnes), Mexico (200,000 tonnes), Australia (150,000 tonnes), Turkey (120,000 tonnes), Yugoslavia (100,000 tonnes), etc.(6). The NATO countries rely heavily on outside sources but the market is at present slack and there is quite a high diversification of imports by member countries.

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(1) 59% of domestic consumption (Newsweek 10.11.80).
(2) "Europe", 12.6.80.
(3) About 15% of total consumption.
(4) It appears that the antimony content of car batteries has dropped over the last 20 years and that even the United States is starting to use a new type of antimony-free battery. Since the developing countries still use traditional batteries, the demand for antimony may be maintained in the future.
(5) United States: 1%.
(6) United States 1973 estimates.

ANNEX III to
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SURVEY OR THE PROJECTS IN THE NON-FERROUS METALS AND URANIUM SECTOR AGREED, STARTED OR IMPLEMENTED BY THE COMECON COUNTRIES IN THE DEVELOPING COUNTRIES

1. USSR

1.1 Africa

1.1.1 Egypt

(1) Geological research and prospection for iron, copper, bauxite, tungsten, chromium, lead, zinc, manganese. Agreement in 1958. In 1962 replacement of the Soviet experts by experts of the firm POWELL DUFFRIN TECHNICAL SERVICES.

(2) Survey of the mining possibilities of manganese ores in the Wadi Elba. Surveys under way in 1961.

(3) Exploration and exploitation of lead/zinc deposits near Um Ching, Eastern desert. Agreement in 1958. Supply of equipment terminated in 1961. Planned start of mining in 1967.

(4) Participation in the construction of a copper plant in Alexandria and of a lead-zinc plant. Agreement in 1964.

(5) Participation in the construction of an aluminium plant at Nag Hammadi. Agreement in 1964. Start of operation in 1975 (production in 1979: 101,200 tons). Extension to 166,000 tons per year not realised because of differences between the two countries.

(6) Soviet geologists discover deposits of lead, zinc, tantalum, molybdenum in the Eastern desert (1970-1972).

1.1.2 Ethiopia

(7) Exploitation of gold deposits, Agreement and start of work in 1960. Presumably still in operation in 1980.

(8) Geological research in Galla Sidamo. Agreement in 1960; start of work in 1964.

(9) Geological research in the provinces Begemdir and Tigre. Protocol in 1968.

(10) Uranium prospection by Soviet experts. Work under way in 1978.

(11) Improvement of the gold mine Adola. Agreement in 1978. Work under way in 1980.

1.1.3 Algeria

(12) Geological prospection of mining resources (lead, zinc, tin, nickel, cobalt, gold, platinum). Agreement and arrival of Soviet technicians in 1968.

(13) Geological examination in North Algeria and in the Hoggar region. Agreement in 1972. 150 Soviet experts worked in Algeria in 1976. Proof of mercury, zinc, lead, antimony, tungsten. On this basis construction of the mercury facility Ismail (317 tons of mercury per year) and the lead/zinc processing facility at El Abede (2,000 tons of ore per day) with Soviet aid.

(14) Participation in the construction of the aluminium plant at M'sila (140,000 tons per year). Agreement in 1976. Planned completion in 1982. Extension to 300,000 tons per year is planned.

(15) Construction of a tin-tungsten mining processing combine near Tamanrasset. Agreement in 1980.

1.1.4 Angola

(16) Establishment of an Angolan-Soviet company for the exploitation of the Angolan mineral deposits. Agreement in 1979.

1.1.5 Benin

(17) Mining examinations. Agreements in 1971 and 1974.

1.1.6 Ghana

(18) Geological research in the region of Tamale. Agreement in 1960. Start of work in 1962. Discovery of gold and manganese deposits.

(19) Soviet participation in the renewed start of operation of the gold refinery in Tarkwa which had been closed in 1966. Agreement presumably in 1976.

1.1.7 Guinea

(20) Geological research for gold and diamonds. Agreement in 1960. Delivery of material in 1962.

(21) Mining of bauxite deposits in Debele (region of Kindia). Agreements in 1969, 1971, 1972, 1976, 1977; additional protocol in 1980. The present annual capacity of 2.5 million tons of bauxite is to be increased to 3 million tons. Guinea delivers annually about 2 million tons of bauxite to the USSR.

1.1.8 Guinea-Bissau

(22) Prospection and mining of bauxite in the region of Boe. Agreement in 1977.

1.1.9 People's Republic of Congo

(23) Geological research for non-ferrous metals and gold near Pointe Noire. Agreement in 1969. During the following years discovery of polymetallic ores.

(24) Delivery of equipment for open-air mining of the polymetallic deposits of Djengilé, construction of a lead ore processing facility near Mfuati, construction of a zinc processing facility. Development of the placer gold deposit Sunda-Kakamoek Agreement in 1975. Lead processing facility in operation since 1978 (plan capacity 35,000 tons per year of lead concentrate). Lead concentrate deliveries to the USSR.

1.1.10 Madagascar

(25) Examination of fixed mineral materials and preparation of a metallurgical map. Agreement in 1978.

1.1.11 Mali

(26) Geological research in the North. Agreement in 1961. Discovery of gold deposits in 1964. Agreements on the continuation of the examination in 1971 and 1972. Gold mining under Soviet direction in several restored gold mines dating back to the Middle Ages North of the Niger bow (between Timbuktu and Burem) under way in 1980.

(27) Exploitation of the gold deposits of Kalana (West Mali). Agreements in 1972 and 1974. Mining started in 1980 with presumably 400 kg of gold (increase to 1,800 kg/year planned).

1.1.12 Morocco

(28) Development and exploitation of mineral resources near Bou Medine (lead, silver, zinc, gold). Protocol in 1966. Agreements in 1967 and 1979.

(29) Mining of cobalt deposits in Abou Azzer. Agreement in 1967. Discovery of new deposits in the region of Quarzazate between 1970 and 1978.

(30) Aid for copper mining near Arganah and Bouskour as well as nickel mining in the central Atlas mountains. Agreement in 1973.

1.1.13 Mauritania

(31) Geological examinations in the region of Aioun. Agreement in 1976.

1.1.14 Mozambique

(32) Geological examination. Agreement in 1976. Bauxite prospection by Soviet geologists in 1978. At least 35 Soviet experts were prospecting in three groups in mineral deposits in 1979.

1.1.15 Nigeria

(33) Geological research in iron and non-ferrous metals. Agreement in 1970. Completion of the iron ore examinations in 1973. Deposits have been found in the State of Rvara.

1.1.16 Zambia

(34) Prospection work. Agreements in 1967, 1974, 1979.

1.1.17 Senegal

(35) Gold prospection in the East of the country. Protocol in 1969. Works under way in 1972.

1.1.18 Sudan

(36) Stocktaking of the mineral resources in the coastal region. Agreement in 1969; third supplement in 1976.

1.1.19 Tanzania

(37) Geological examinations in Mpanda, Sumbawanga and Kigoma. Agreement in 1969. Examinations after 1979 under way; i.e. participation in the gold mining of the Lupa/Chunya district.

1.1.20 Chad

(38) Geological research. Agreement in 1968.

1.1.21 Uganda

(39) Geological-mineralogical examinations. Agreement in 1978.

1.1.22 Central African Republic

(40) Prospection work. Agreement in 1970.

1.2 Asia

1.2.1 Afghanistan

(41) Exploration of mineral resources. Agreement in 1958.

(42) Prospection work, especially for copper. Agreement in 1974.

(43) Feasibility studies on the copper complex Ainak. Agreements in 1977 and 1978. Destruction of the mining facilities and killing of the Soviet experts and Afghan workers by rebels in April 1980.

1.2.2 Burma

(44) Exploration of the tin and tungsten mines Mawchi. Mining with Soviet experts was resumed in 1970.

1.2.3 India

(45) Technical aid for the construction of the aluminium plant at Korba (capacity 100,000 tons per year). Agreement in 1966. Completion in 1979.

(46) Aid for the construction of the copper mining and processing combine of Malanykhand. Agreements in 1966 and 1977. Plant production up to 100,000 tons of Cu concentrate in 1985.

(47) Financial support for the construction of an alumina plant in Andhra Pradesh (plan production 600,000 tons). Agreement in 1978. The USSR is willing to purchase the entire production on a compensation basis (1980).

(48) Aid for the nickel project Sukinda/Orissa. Agreement in 1979.

(49) Aid for the construction of the copper plant Ghatsila. Agreement in 1979.

1.2.4 Indonesia

(50) Geological research in Borneo. Agreement in 1964. The works stopped presumably in 1965.

(51) Aid for the construction of a bauxite plant on the island of Bintan. The intended agreement was not concluded in 1977 because the credit conditions could not be agreed.

1.2.5 Iraq

(52) Geological examinations. Agreement in 1959. Examinations of uranium deposits near Akkasha by a Soviet group of geologists in 1973.

1.2.6 Iran

(53) Construction of an alumina plant near Teheran (annual capacity 500,000 tons). Agreement in 1976.

(54) Joint development of mineral resources. Protocol in 1977. Uranium prospection under way in 1976/77.

1.2.7 North Yemen

(55) Geological examinations. Agreement in 1964.

1.2.8 South Yemen

(56) Prospection and exploration works. Agreement in 1972. Discovery of gold, silver, titanium and copper deposits in the central region.

1.2.9 Jordan

(57) Geological examinations. Agreements in 1969 and 1972.

1.2.10 Laos

(58) Modernization of the tin mines in the province of Khammouan. Agreement in 1979.

1.2.11 Malaysia

(59) Five-year agreement, i.e. for the exploration and exploitation of metal deposits, in 1972.

1.2.12 Nepal

(60) Geological aid in exploitation of ores. Magnesium deposits found in 1969.

1.2.13 Pakistan

(61) Examination of mineral resources. Agreement in 1966.

1.2.14 Sri Lanka

(62) Aid for the construction of an alumina plant. Agreement in 1972.

(63) Aid for the construction of a processing facility for titanium ore (ilmenite). Agreement in 1974. Soviet experts process ilmenite from Sri Lanka into titanium-containing slag (1979).

1.2.15 Syria

(64) Examinations of deposits of iron ore, manganese, chromium. Agreement in 1957. Completion of the works and discovery of relevant deposits in 1960.

1.3 Latin America

1.3.1 Bolivia

(65) Construction of 4 tin volatilization facilities. Agreement in 1971. Supplementary agreement in 1977. Start of operation of the first facility in La Palca near Potosi presumably in 1982. A second facility at Machacamarca near Oruro is in the planning stage. A third facility at Quechisla near Atocha has been offered.

(66) Construction of a copper and zinc plant on Lake Titicaca. Agreements in 1970 and 1972. 1974: Bolivia is said to consider that the facility is not sufficiently cost-effective.

1.3.2 Chile

(67) Geological research. Agreement in 1972.

1.3.3 Costa Rica

(68) Bauxite mining and aluminium project Valle el Grande. Agreement in 1977.

1.3.4 Guayana

(69) Feasibility studies on bauxite and alumina exploitation. Agreement in 1978.

1.3.5 Jamaica

(70) Copper and nickel prospection. Agreement in 1977.

1.3.6 Mexico

(71) Aid for mining development. Agreement in 1976.

1.3.7 Peru

(72) Mining co-operation. Agreement in 1971.

2. GDR

2.1 Africa

2.1.1 Ethiopia

(1) Agreement in co-operation in the sectors geology and mining in preparation in November 1978, concluded presumably in December 1979.

2.1.2 Algeria

(2) Employment of mining engineers, technicians and geologists (in 1976 about 10 experts).

2.1.3 Angola

(3) Economic agreement on increased mineral exploration, 1978.

2.1.4 Mozambique

(4) Co-operation agreement on gold and copper mining in 1978. Copper concentrate deliveries to the GDR.

2.1.5 Zambia

(5) Despatch of a team of geologists for uranium exploration. Agreement in 1980 (copper supply agreement concluded in the same year).

2.2 Asia

2.2.1 Iraq

(6) Mineral resource survey of the country. Works under way since 1972, presumably completed in 1980. 24 experts dealt specifically with uranium prospection in the North in 1974.

2.3 Latin America

2.3.1 Guayana

(7) Development of the bauxite industry. Agreements in 1977 and 1979. Bauxite deliveries to the GDR.

3. BULGARIA

3.1 Africa

3.1.1 Algeria

(1) Development of lead/zinc deposits of Kherzet Youssef (planned production 20,000 tons of zinc concentrate and 3,800 tons of lead concentrate). Agreements in 1970 and 1976.

(2) Prospection works. Agreement in 1964.

3.1.2 Ghana

(3) Prospection works. Agreement in 1961.

3.1.3 Guinea

(4) Prospection and mining of mineral resources, especially bauxite and iron ore. Agreements in 1976 and 1980.

3.1.4 People's Republic of Congo

(5) Development of mining in Mindouli. Agreement in 1972. Discovery of copper, zinc and lead deposits in 1975.

3.1.5 Senegal

(6) Aid for prospection and mining. Agreement in 1978.

3.1.6 Somalia

(7) Exploration and exploitation of tin in the region of Mayayan-Dalan. Agreement in 1972. Mining with Bulgarian aid still under way in 1978.

(8) Prospection works. Agreement in 1972. Nickel, tin and gold deposits discovered until 1976.

3.1.7 Sudan

(9) Development of mineral deposits. Agreement in 1967.

3.1.8 Tunisia

(10) Geological examinations near Bizerba, Beja, Ghardimaou. Agreement in 1968. In 1980 Bulgaria submitted a planning study for the improvement of the lead/zinc mine Bou Jabeur, NW Tunis.

3.2 Asia

3.2.1 India

(11) Construction of non-ferrous metallurgical facilities. Agreement in 1967.

3.2.2 Iran

(12) Development of copper mining. Agreement in 1967.

3.3 Latin America

3.3.1 Mexico

(13) Agreement, i.a. on prospection and joint mining companies in 1979.

4. CZECHOSLOVAKIA

4.1 Africa

4.1.1 Egypt

(1) Research on copper deposits. Works presumably in 1957/58.

(2) Construction of a metal melting plant in Cairo. Agreement in 1965.

4.1.2 Algeria

(3) Geological research in the region of Béchar. Agreement in 1969.

4.1.3 Libya

(4) Mineral prospection. Czech geologists were in the country for several months in 1979.

4.1.4 Morocco

(5) Copper development in Talaat Nouamane. Agreement in 1962. A processing facility started operation in 1965.

(6) Examination of the copper deposit Nador, Central Atlas. Agreement in 1972.

4.1.5 Nigeria

(7) Development and mining of tin on the Jos plateau. Agreement in 1971.

4.1.6 Zambia

(8) Copper prospection and feasibility studies. Agreement in 1971. Activities of CSSR geo-physicists in 1976.

4.2 Asia

4.2.1 Burma

(9) Examinations of nickel ores in 1974.

4.2.2 Indonesia

(10) Development of mineral mining. Agreement in 1960.

4.2.3 Iraq

(11) Construction of a non-ferrous metals rolling mill. In the planning stage in 1979/80.

4.2.4 Iran

(12) Construction of a processing facility for lead ores (province of Isfahan). Start of operation in 1959.

(13) Construction of a processing facility for copper ores (province Isfahan). Start of operation in 1965.

4.2.5 South Yemen

(14) Mineral prospection. Agreement in 1973.

4.3 Latin America

4.3.1 Bolivia

(15) Construction of an antimony plant in Vinto. Agreement in 1971. Completion in 1976. Capacity 5,000 tons per year of antimony concentrate and 1,000 tons per year of antimony oxyde. Extension to 11,000 tons per year is planned.

5. POLAND

5.1 Africa

5.1.1 Algeria

(1) Examination of lead and zinc deposits near Guerrouma and Sakamooy. Agreement in 1969.

5.1.2 Angola

(2) Mineral exploration. Agreement in 1977.

5.2 Asia

5.2.1 India

(3) Technical aid for the construction of the zinc plant in Vishakhapatnam (capacity 30,000 tons per year). Agreement in 1962. Completion in 1977.

5.2.2 Iran

(4) Mining support. Agreement in 1978.

5.3 Latin America

5.3.1 Bolivia

(5) Feasibility study on the zinc plant at Potosi. Agreement in 1972.

5.3.2 Brazil

(6) Participation in the construction of the Caraiba copper project. Works under way in 1979.

5.3.3 Chile

(7) Metallurgy and mining co-operation. Agreement in 1971.

6. ROMANIA

6.1 Africa

6.1.1 Algeria

(1) Development of the copper deposits in the Cavallo region. Agreement in 1968.

(2) Prospection for precious metals in the Hoggar region. Agreement in 1968. Gold and uranium deposits were found about 1972.

(3) Mining of barium deposits in the Algier region. Agreement in 1968.

(4) Prospection works. Agreements in 1972 and 1974.

6.1.2 Benin

(5) Mining co-operation. Agreement in 1978.

6.1.3 Burundi

(6) Exploitation of nickel deposits. Agreement in 1979.

6.1.4 Ivory Coast

(7) Development of mineral deposits. Agreement in 1975. Discovery of nickel, gold, copper and manganese ore deposits in 1976.

6.1.5 Guinea

(8) Mining and processing of bauxite in the region of Boke. Agreement in 1974. Bauxite deliveries to Romania.

(9) Participation in the construction of an aluminium plant in Ayekoye within the framework of an international consortium. Agreement in 1980.

6.1.6 Kenya

(10) Mining of lead, silver and zinc in the region of Kilifi. Agreement in 1970. Operation discontinued because of financial and technical difficulties in 1977.

(11) Extension of the mining co-operation. Protocol of 1975.

6.1.7 People's Republic of Congo

(12) Geological examinations. Agreement in 1969.

6.1.8 Morocco

(13) Copper exploration and exploitation. Agreements in 1968 and 1973. The copper mine Ouansimi and the flotation facility Iminirfi have been constructed with Romanian aid.

(14) Construction of a lead foundary. Agreement in 1973.

6.1.9 Mauritania

(15) Co-operation in the mining sector. Agreements in 1974 and 1977.

6.1.10 Zambia

(16) Copper prospection. Agreement in 1970. Copper development near Mokambo. Agreement in 1972. Development of the copper mine Mokambo was discontinued in 1976.

(17) Mining of coal, nickel, lead, phosphate and uranium. Agreement in 1980.

6.1.11 Senegal

(18) Development of mineral deposits. Agreement in 1977.

6.1.12 Sudan

(19) Mining of the copper deposit Hofrat en Nahas. Protocol in 1975.

6.1.13 Tanzania

(20) Development of the copper deposit in the Kigugwe region. Agreement in 1971.

6.1.14 Tunisia

(21) Development of mineral deposits. Agreement in 1967.

6.1.15 Central African Republic

(22) Exploitation of ore, oil and diamant deposits. Agreement in 1974.

6.2 Asia

6.2.1 Iran

(23) Copper prospection in the region of Abbassabad. Agreement in 1968.

(24) Aid for ore mining (planning and supply of a copper washing facility). Agreement in 1970. Facility in operation since 1973.

6.2.2 Syria

(25) Mineral exploration. Agreement in 1976.

6.3 Latin America

6.3.1 Argentina

(26) Tungsten mining near Guandacol. Agreement in 1974.

6.3.2 Chile

(27) Exploration of copper, lead, zinc, tungsten in North Chile. Agreement in 1972. From 1976 production and supply of minor quantities of copper and lead/zinc concentrates.

6.3.3 Costa Rica

(28) Exploitation of bauxite deposits and supply of equipment for the aluminium production. Feasibility studies in 1977. Agreement in 1980.

6.3.4 Peru

(29) Copper-zinc mining project "Antamina". Agreement in 1973. The project stagnates because of technical and financial difficulties.

7. HUNGARY

7.1 Africa

7.1.1 Ghana

(1) Survey of bauxite deposits near Kibi and Nyinahin completed by Hungarian experts in 1978. Agreement in 1974.

7.1.2 Guinea

(2) Technical aid for the development of bauxite mining. Agreement in 1960.

7.1.3 Mali

(3) Examinations for the possible development of an aluminium industry. Agreement in 1972.

7.2 Asia

7.2.1 India

(4) Financial and technical aid for the construction of alumina facilities in Korba and Konya. Agreement in 1966. Planned capacity of the facility in Korba 200,000 tons per year. Start of the first construction stage in 1973.

(5) Feasibility study for the construction of an alumina plant in the district of Kutch/Gujarat (planned capacity 300,000 tons per year). Agreement in 1978.

(6) Aluminium plant project in the district of Ratnagiri. Agreement in 1973. Consideration not yet completed in 1980.

(7) Extension of the capacity of the aluminium plant at Uttar Pradesh. Agreement in 1980.

7.2.2 Jordan

(8) Copper prospection in the region of Wadi Araba. Agreement in 1972.

7.2.3 Sri Lanka

(9) Participation in the construction of an ilmenite processing facility. Agreement in 1978.

7.3 Latin America

7.3.1 Bolivia

(10) Construction of a copper processing facility and plant. Agreement in 1970.

7.3.2 Chile

(11) Copper mining co-operation. Agreement in 1971.

7.3.3 Jamaica

(12) Construction of an alumina plant in the region of Manchester (planned capacity 600,000 tons per year). Agreement in 1979. Agreement on annual alumina deliveries of 150,000 tons to Hungary (cancelled at the end of 1979/beginning of 1980).

7.3.4 Peru

(13) Construction of a lead-zinc processing facility. Agreement in 1970.