Commission of the European Communities

Evaluation of the Community's primary mineral raw materials programme

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Commission of the European Communities

Evaluation of the Community's primary mineral raw materials programme

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RESUME

Programmets politiske baggrund og forhistorie

Råoliepriserne hurtige stigning i begyndelsen af 1970'erne påvirkede stærkt markedet for ikke-brændselsmineraler. Samtidig førte en betydelig stigning i verdensforbruget til stærkt stigende priser og de vigtigste varer (nemlig bauxit, phosphat, kobber, tin, nikkel, chrom, platin og zink).

Kommissionen udarbejdede et forslag til et flerårigt forsknings- og udviklingsprogram på området primære råstoffer (1979-1981), som byggede på henstillinger fra medlemsstaternes delegationer (KOM(77) 284). Ved en rådsafgørelse blev dette forslag vedtaget og ligeledes Det rådgivende Udvalg for Programforvaltning (CCMGP) nedsat (6. marts 1978). CREST-underudvalget for F&U vedrørende råstoffer og CCMGP udfoldede deres virksomhed i samarbejde med råvaresekretariatet i Kommissionens generaldirektorat for industrien, idet en repræsentant for sekretariatet deltog i de ovenfor nævnte rådgivende udvalgs møder.

Programmets hovedmålsætninger var

- at øge potentiellet for selvforsyning med råstoffer for Fællesskabet som helhed
- at reducere handelsbalanceunderskuddene
- at udvikle og eksportere ny teknologi til mineralefterforskning og -udvinding.

Det tekniske indhold af F&U-programmet for primære råstoffer byggede på den formodning, at det på EF's område stadig er muligt at opdage nye mineralressourcer, der findes som skjulte og/eller dybtliggende forekomster. Endvidere er der store uudnyttede reserver af komplekse eller lavlødige malme, og der bør ligeledes tages hensyn til små højværdige forekomsters potentiel.

Program under revision (1978-1981)

Der blev i GD XII nedsat et forvaltningsudvalg til gennemførelse af programmet, og det blev bistået af et rådgivende udvalg (CCMGP) bestående af repræsentanter for medlemsstaterne.

Der blev tildelt 15,5 mio ECU til 140 projekter ud af 270 projektforslag.

Alle kontrakterne var med omkostningsdeling (indirekte aktion), idet Kommissionen afholdt ca. 50% af omkostningerne.

Programmet bestod af tre hovedforskningsområder:

a) Efterforskning:
   Søgning efter dybtliggende eller skjulte forekomster under anvendelse af
   - måludvælgelse gennem større viden om anvendte geovidenskaber
   - forbedring og udvikling af prospekteringsmetoder.

b) Malmoparbejdning:
   F&U med henblik på forbedring af udvindings- og oparbejdningsteknikker, især til lavlødige og komplekse malme
   - gennemførligheds- og modelundersøgelser
   - generelle malmoparbejdningsmetoder
   - konkret udvikling til udludning på stedet af kobber, alternative aluminiumoxidkilder, finkornede bly/zinkmalme (sulfider og oxider) samt anvendelse af chlorering og andre processer på malme, slagger og skrot.

c) Mineteknik:
   F&U vedrørende problemer med dybtliggende forekomster og små højværdige malmlegemer
   - brydnings- og genopfyldningsteknikker
   - undersøgelser vedrørende mobile integrerede anlæg
   - fortegnelse over visse forekomster i Europa.

Konklusioner

Sammenfattende om panelets synspunkter må det konstateres, at programmets målsætninger er opfyldt. Det arbejde, der er udført under programmet, er af prisværdig høj teknisk kvalitet, som er et godt udtryk for de kontraherende organers og det undertiden særdeles overbebyrdede EF-personales kompetence.

Imidlertid spændte kontrakterne over så stort et område og midlerne var så beskedne i forhold til programmets mål, at den samlede økonomiske virkning ved første øjekast måtte forventes at være forholdsvis begrænset. Alligevel havde programmet en afgjort positiv virkning, og på mange områder viste det udførte arbejde sig at føre til yderligere udviklinger, som vil få afgørende indflydelse på opdagelse og indvinding af metaller og mineraler.

Den erklærede hensigt ved starten af det program, der er under revision, var bestemt af de politiske og økonomiske begrænsninger, der rådede umiddelbart efter de værste virkninger af oliekrisen, og som i mellemtiden har ændret sig væsentligt. I modsætning til andre områder bliver området primære råstoffer imidlertid stærkt påvirket af store udsving i forholdet mellem udbud og efterspørgsel, som synes at gentage sig regelmæssigt. Derfor må der i EF's forskningspolitik vedrørende råstoffer tages hensyn til disse forhold og de tilsvarende udsigter på lang sigt.

Panelet fandt, at for så vidt angår det første programs mål (1978-1981) stod budgetbevillingerne ikke i rimeligt forhold til de støttede projekters spændvidde og antal.

Henstillinger vedrørende fremtidige programmer

1. Først og fremmest henstiller panelet, at EF når til enighed om en klart defineret sammenhængende europæisk forskningspolitik vedrørende råstoffer, så der kan indtages et strategisk standpunkt med hovedvægten på overblik og EF's fordele på lang sigt. Panelet er klar over, at en sådan opgave

indebærer en række vanskeligheder, men finder alligevel, at et sådant skridt er afgørende for, at den europæiske mineralindustri kan udvikle sig til en konkurrencedygtig industri.

En sådan politik bør bygge på:

- en regelmæssig ajourført detaljeret oversigt over de strategiske følgevirknigner af udbud af og efterspørgsel efter primære råstoffer i Fællesskabet
- en udnersøgelse af følgevirknignerne af de voldsomme udsving i udbud/efterspørgselsforholdet, som påvirker strukturen i markedet for primære råstoffer, og af de skridt, EF bør tage på kort og lang sigt
- en undersøgelse af problemet med bevaring af viden inden for råstofefterforskning og -produktion, således at EF bliver i stand til at anvende og eksportere avanceret teknologi
- en undersøgelse af, hvilke socio-økonomiske virkninger behovet for større selvforsyning med primære råstoffer har på Fællesskabet, herunder de miljømæssige begrænsninger
- en vurdering af Kommissionens stilling på dette område som helhed, nemlig om den blot bør virke som katalysator og sætte sin lid til, at statslige myndigheder eller organisationer sørger for den drivende kraft på F&U-området, og/eller om Kommissionen bør være ansvarlig, dvs. sætte sig selv i stand til at lede, definere og gennemføre specifikke projekter på multilateral/international basis, med Fællesskabets fordele som hovedformål i stedt for summe af de nationale hensyn.

2. Kommissionen har desuden behov for at formulere en forskningspolitik og fastsætte, hvor stor en andel af støtten der bør anvendes til den generelle ekspertiseforøgelse i Fællesskabet i forhold til de områder med umiddelbar økonomisk betydning, som lettere kan begrundes. På længere sigt kan det meget vel vise sig, at forbedring af grundlæggende teknikker indebærer større fordele end støtte til visse projekter af mere empirisk art, som på det pågældende tidspunkt syntes at være berettiget til omgående støtte.

3. Kommissionen bør drage omsorg for, at programmerne i fremtiden får tilstrækkelige midler, således at de fastsatte målsætninger i højere grad kan opfyldes. Panelet er klar over, at budgetbevillingerne ikke er ubegrænsede, men henstiller, at Kommissionen alligevel følger de ovenfor beskrevne generelle principper med skyldig hensyntagen til den aktuelle prioritering.

ZUSAMMENFASSUNG

Politischer Hintergrund und Vorgeschichte des Programms

Der rasche Anstieg der Rohölpreise Anfang der siebziger Jahre hat den Markt für nichtbrennbare Mineralien stark beeinflußt. Gleichzeitig verursachte der starke Anstieg des weltweiten Verbrauchs einen Preisboom bei den meisten wichtigen Waren (hauptsächlich Bauxit, Phosphat, Kupfer, Zinn, Nickel, Chrom, Platin und Zink).

Die Kommission hat einen Vorschlag für ein FuE-Mehrjahresprogramm auf dem Gebiet primärer Rohstoffe (1978-81) auf der Grundlage der Empfehlungen der einzelstaatlichen Delegationen (KOM(77)284) ausgearbeitet. In einem Ratsbeschluß wurde dieser Vorschlag verabschiedet, in dem auch der Beratende Programmausschuß ernannt wurde (6. März 1978). Die Tätigkeiten des CREST-Unterausschusses über Forschung und Entwicklung auf dem Gebiet der Rohstoffe sowie die Tätigkeiten des BPA wurden in Zusammenarbeit mit dem Sekretariat für Rostoffe der Generaldirektion Gewerbliche Wirtschaft der Kommission über die direkte Beteiligung eines Vertreters des Sekretariats an den Sitzungen der obengenannten beratenden Gremien festgelegt.

Hauptziele des Programms :

- Erhöhung des Selbstversorgungspotentials von Rohstoffen für die gesamte Gemeinschaft ;
- Senkung der Handelsbilanzdefizite ;
- Entwicklung und Ausfuhr neuer Technologien für die Exploration und den Abbau von Mineralien.

Die technischen Inhalte des FuE-Programms über primäre Rohstoffe gründen sich auf der Überzeugung, daß Mineralvorkommen in verborgenen und/oder tiefliegenden Lagerstätten auf dem Gebiet der Gemeinschaft noch gefunden werden können. Außerdem gibt es noch umfangreiche nichtabgebaute Reserven von komplexen - bzw. geringhaltigen Erzen. Das Potential der hochhaltigen Lagerstätten geringen Umfangs sollte ebenfalls berücksichtigt werden.

Programm in Revision (1978-1981)

In der GD XII wurde eine Gruppe für die Durchführung des Programms eingesetzt. Außerdem unterstützte ein aus Vertretern der Mitgliedstaaten bestehender Beratender Ausschuß (BPA) die Kommission bei der Durchführung des Programms.

Ein Betrag von 15,5 Millionen ECU wurde für 140 Vorhaben zugewiesen, die aus 270 Vorschlägen ausgewählt wurden.

Alle Verträge waren auf Kostenteilungsbasis (indirekte Aktion) :
die Gemeinschaft übernahm ungefähr 50% der Kosten.

Das Programm umfaßte drei wesentliche Forschungsbereiche :

a) Exploration :
   Tiefliegende bzw. verborgene Lagerstätten
   - Auswahl von Zielegebieten durch bessere Kenntnisse auf dem Gebiet der Geowissenschaften ;
   - Verbesserung und Entwicklung von Schürfmethoden.

b) Aufbereitung von Erzen :
   FuE zur Verbesserung der Abbau- und Aufbereitungstechniken insbesondere für geringhaltige und komple Erze ;
   - Durchführbarkeits- und Modellstudien ;
   - allgemeine Erzaufbereitungsmethoden ;
   - spezifische Entwicklungen für Kupfer-in situ-laugung, alternative A1-Rohstoffe, feinkörnige Erze Blei-Zink (Sulfide und Oxide), Chlorierungs- und andere Verfahren für Erze, Schlacken und Rückstände.

c) Montantechnologie :
   FuE im Zusammenhang mit tiefen Lagerstätten und hochhaltigen Vorkommen geringen Umfangs
   - Abbau- und Versatztechnologien
   - Studien für integrierte mobile Anlagen
   - Bestandsaufnahme bestimmter europäischer Vorkommen.

Schlußfolgerungen

Als Zusammenfassung der Meinungen des Ausschusses kann festgestellt werden, daß die Ziele des Programms erreicht wurden. Die technische Qualität der im Rahmen des Programms durchgeführten Arbeit ist anerkanntermaßen hoch und spricht in hohem Maße für die Kompetenz der vertragnehmenden Partner und des manchmal überlasteten EG-Personals.

Die Verträge umfassten jedoch einen so großen Bereich und die Höhe der Mittel war im Verhältnis zu den Zielen des Programms so niedrig, daß man eigentlich damit hätte rechnen können, das die wirtschaftliche Auswirkung insgesamt irgendwie beschränkt sein würde. Die Auswirkung des Programms war jedoch ganz eindeutig positiv. Die auf mehreren Gebieten durchgeführte Arbeit stellte sich als nützlich für weitere Entwicklungen heraus, die sich in hohem Maße auf die Entdeckung und Rückgewinnung von Metallen und Mineralien auswirken werden.

Die erklärte Absicht bei Beginn des zu prüfenden Programms wurde bestimmt durch die vorherrschenden politischen und wirtschaftlichen Zwänge, die direkt im Anschluß an die schlimmsten Auswirkungen der Ölkrise herrschten und die sich mittlerweile erheblich verändert haben. Der Bereich der primären Rohstoffe wird im Vergleich zu anderen Bereichen stärker durch ausgeprägte Schwankungen im Angebot/Nachfrage-Verhältnis beeinflußt, deren Auftreten sich periodisch abzuzeichnen scheint. Bei jeder EG-Forschungspolitik im Zusammenhang mit Rohstoffen müssen folglich diese Bedingungen und die entsprechend langfristige Vorausschau berücksichtigt werden.

Der Ausschuß war der Auffassung, daß im Zusammenhang mit den Zielen des ersten Programms (1978-1981) die Mittelzuweisung nicht mit dem Ziel und der Anzahl der unterstützten Vorhaben im Einklang stand.

Empfehlungen für zukünftige Programme

1. Der Ausschuß empfiehlt in erster Linie, daß sich die EG über eine klar definierte kohärente Europäische Forschungspolitik auf dem Gebiet der Rohstoffe einigen sollte um eine vorausschauende Strategie mit Betonung auf überblick und langfristigem Vorteil der Gemeinschaft zu ermöglichen. Der Ausschuß erkennt an, daß eine solche Aufgabe inhärente

Schwierigkeiten birgt, er ist jedoch der Auffassung, daß dies für die entscheidende Entwicklung einer wettbewerbsfähigen Mineralindustrie in Europa wesentlich ist.

Eine solche Politik sollte beinhalten :

- einen periodisch auf den neuesten Stand gebrachten umfassenden Überblick der strategischen Begleiterscheinungen von Angebot und Nachfrage primärer Rohstoffe innerhalb der Gemeinschaft ;
- eine Studie über die Auswirkungen der sehr starken Schwankungen im Angebot/Nachfrage-Verhältnis, die den Bereich der primären Rohstoffe strukturell betreffen, sowie über die kurzfristigen und langfristigen Aktionen, die von der EG durchgeführt werden sollen ;
- eine Studie über das Problem des Schutzes des know-how auf dem Gebiet der Exploration und Abbau von Rohstoffen damit die EG die Möglichkeit hat, fortgeschrittenen Technologien einzusetzen und zu erportieren ;
- eine Studie über die sozio-ökonomischen Auswirkungen auf die Gemeinschaft einschließlich der Umweltauflagen aufgrund des Bedürfnisses nach größerer Unabhängigkeit im bezug auf primäre Rohstoffe ;
- eine Studie, um die Position der Kommission in ihrer Rolle auf diesem Gebiet insgesamt zu bewerten, d.h. ob die Kommission rein als Katalysator auftreten sollte oder darüberhinaus. In anderen Worten ausgedrückt, sie könnte sich auf Regierungen bzw. Organisationen verlassen, die die Initiative auf dem Gebiet der Forschung und Entwicklung liefern und/oder die Kommission könnte stärker verantwortlich sein, und eigene Fähigkeiten entwickeln, um spezifische Vorhaben auf multilateraler/internationaler Basis zu leiten, zu definieren und durchzuführen. Dies jedoch mit der wesentlichen Überlegung, daß sie für die Gemeinschaft nutzbringend sind und nicht so sehr die verschiedenen einzelstaatlichen Überlegungen vertreten.

2. Die Kommission muß auch eine Forschungspolitik ausarbeiten,die Grundlage für die Mittelverteilung sein sollte, sodaß die Weiterentwicklung mehr genereller, die für die Ergebnisse im Gegensatz zu den leichter zu rechtfertigenden Bereichen von sofortiger wirtschaflicher Bedeutung in der Gemeinschaft möglich wird. Der langfristige Nutzen einer

Verbesserung der grundlegenden Techniken könnte sehr wohl größer sein als der Nutzen aus der Unterstützung einiger mehr empirischer Vorhaben, die eine dringende Finanzierung zu rechtfertigen scheinen.

3. Die Kommission sollte sicherstellen, daß zukünftige Programme in angemessener Weise finanziert werden, um den definierten Zielen in größerem Maße gerecht zu werden. Der Auschuß erkennt an, daß es im Hinblick auf die Mittelzuweisungen Grenzen gibt. Er empfiehlt jedoch, daß die Kommission dennoch das oben beschriebene allgemeine Vorgehen zur Prüfung im Hinblick auf die allgemein gültigen Prioritäten verfolgt.

ΣΥΝΟΨΗ

Πολιτική βάση και ιστορικό του προγράμματος

Η ραγδαία αύξηση των τιμών του αργού πετρελαίου στις αρχές της δεκαετίας του 1970 επηρέασε έντονα την αγορά των μη καυσίμων ορυκτών. Ταυτόχρονα η μεγάλη άνοδος της παγκόσμιας κατανάλωσης προκάλεσε έκρηξη στις τιμές των περισσότερων από τα σημαντικά μεταλλεύματα, (συγκεκριμένα, βωξίτης, φωσφορικά, χαλκός, κασσίτερος, νικέλιο, χρώμιο, λευκόχρυσος και ψευδάργυρος).

Η Επιτροπή κατάρτισε πρόταση για πολυετές πρόγραμμα Ε και Α στον τομέα των πρωτογενών πρώτων υλών (1978 - 1981) με βάση τις συστάσεις των εθνικών αντιπροσωπειών (COM (77) 284). Με απόφαση του Συμβουλίου εγκρίθηκε η πρόταση αυτή και συστήθηκε επίσης η Συμβουλευτική Επιτροπή Διαχείρησης Προγραμμάτων (ΣΕΔΠ) (6 Μαρτίου 1978). Οι δραστηριότητες της υποεπιτροπής της CREST για Ε και Α. Πρώτες Ύλες και της ΣΕΔΠ αναπτύχθησαν σε συνεργασία με τη γραμματεία πρώτων υλών της γενικής διεύθυνσης βιομηχανικών υποθέσεων της Επιτροπής, με άμεση συμμετοχή αντιπροσώπων της γραμματείας στις συνεδριάσεις των συμβουλευτικών αυτών οργάνων.
Κύριοι στόχοι του προγράμματος ήταν :

- η αύξηση του δυναμικού αυτοεφοδιασμού σε πρώτες ύλες για την Κοινότητα σαν σύνολο,
- η μείωση των ελλειμμάτων του εμπορικού ισοζυγίου,
- η ανάπτυξη και εξαγωγή νέων τεχνολογιών για την αναζήτηση και εκμετάλλευση των ορυκτών.

Το τεχνικό περιεχόμενο του προγράμματος Ε και Α για τις πρωτογενείς πρώτες ύλες βασίστηκε στην πεποίθηση ότι υπάρχουν και άλλες πηγές ορυκτών στο έδαφος της Ευρωπαϊκής Κοινότητας (ΕΚ) με τη μορφή κοιτασμάτων που είναι κρυμμένα και /ή βρίσκονται σε μεγάλα βάθη.
Επί πλέον, υπάρχουν ακόμα μεγάλα ανεκμετάλλευτα αποθέματα συνθέτων ή χαμηλής ποιότητας μεταλλευμάτων και θα πρέπει επίσης να ληφθούν υπόψη οι δυνατότητες που προσφέρονται από μικρές ποσότητες μεταλλευμάτων υψηλής ποιότητας.

Το υπό επανεξέταση πρόγραμμα (1978 - 1981)

Στη ΓΔ XII συστήθηκε ομάδα διαχείρισης για την υλοποίηση του προγράμματος ενώ μια συμβουλευτική επιτροπή (ΣΕΔΠ) αποτελούμενη από αντιπροσώπους των κρατών μελών βοήθησε την Επιτροπή στην υλοποίηση του προγράμματος.
Χορηγήθηκε ποσό 15,5 εκατομμυρίων ECU για 140 έργα που επιλέχθηκαν ανάμεσα σε 270 προτάσεις.
Όλες οι συμβάσεις ήταν κοινής δαπάνης (έμμεσες ενέργειες) : η Κοινότητα ανέλαβε το 50% περίπου των δαπανών.
Το πρόγραμμα περιέλαβε τρεις κύριους ερευνητικούς τομείς :

α) Διερεύνηση :

Αναζήτηση κοιτασμάτων που είναι κρυμμένα ή βρίσκονται σε μεγάλα βάθη με
- επιλογή στόχου με βελτίωση των γνώσεων στην εφαρμοσμένη γεωλογία,
- βελτίωση και ανάπτυξη μεθόδων για μεταλλευτικές έρευνες.

β Επεξεργασία μεταλλευμάτων :
Ε και Α για τη βελτίωση των τεχνικών εξαγωγής και επεξεργασίας ιδίως για μεταλλεύματα χαμηλής ποιότητας και σύνθετα,
- μελέτες σκοπιμότητας και μοντέλων,
- γενικές μέθοδοι επεξεργασίας μεταλλευμάτων,
- ειδικές εξελίξεις στην επιτόπια έκπλυση του χαλκού, τις εναλλακτικές πηγές αλουμίνας, τα λεπτόκοκκα μεταλλεύματα μολύβδου / ψευδαργύρου (θειούχα και οξείδια), τη χλωρίωση και άλλες κατεργασίες που εφαρμόζονται σε μεταλλεύματα, οκωρίες και υπολείμματα.

γ) Τεχνολογία εξόρυξης :

Ε και Α σε προβλήματα βαθιών κοιτασμάτων και στρωμάτων μεταλλεύματος υψηλής ποιότητας σε μικρές ποσότητες
-τεχνολογίες εξόρυξης και αποκατάστασης των ορυγμάτων,
-μελέτες για ενοποιημένες κινητές εγκαταστάσεις,
-απογραφή ορισμένων ευρωπαϊκών κοιτασμάτων.

Συμπεράσματα

Συνοψίζοντας τις απόψεις της ομάδας μπορεί κανείς να πεί ότι οι στόχοι του προγράμματος εκπληρώθηκαν. Η τεχνική ποιότητα του έργου που πραγματοποιήθηκε στα πλαίσια του προγράμματος αξίζει επαίνους για την υψηλή στάθμη της και αντιπροσωπεύει την ικανότητα των ομάδων που συμμετείχαν στις συμβάσεις καθώς και του προσωπικού της ΕΚ που συχνά εργάστηκε με υπερένταση.
Το αντικείμενο των συμβάσεων, όμως ήταν τόσο ευρύ και το ύψος των πιστώσεων τόσο χαμηλό, σε σχέση με τους στόχους του προγράμματος ώστε θα περίμενε κανείς με πρώτη ματιά η συνολική οικονομική επίδραση να είναι κάπως περιορισμένη. Παρόλα αυτά, τα αποτελέσματα του προγράμματος ήταν οπωσδήποτε θετικά και το έργο που πραγματοποιήθηκε σε πολλούς τομείς θα χρησιμεύσει σαν μέσο για παραπέρα εξελίξεις που θα έχουν σημαντικές επιπτώσεις στον εντοπισμό και την ανάκτηση μετάλλων και ορυκτών μεταλλευμάτων.

Οι σκοποί που αναφέρονται στην αρχή του υπό επανεξέταση προγράμματος κατευθύνονταν από τις τρέχουσες οικονομικές και πολιτικές ανάγκες που δημιουργήθηκαν αμέσως μετά τις χειρότερες συνέπειες της κρίσης του πετρελαίου και που, στο μεταξύ, έχουν μεταβληθεί σημαντικά. Παρόλα αυτά, ο τομέας των πρωτογενών πρώτων υλών, σε αντίθεση με άλλους, επηρεάζεται εντονότερα από μεγάλες αλλαγές στην αναλογία προσφοράς/ζήτησης που παρατηρούνται περιοδικά. Κατά συνέπεια, η ερευνητική πολιτική της ΕΚ για τις πρώτες ύλες πρέπει να λαμβάνει υπόψη τις συνθήκες αυτές και τις αντίστοιχες μακροπρόθεσμες προοπτικές.

Η ομάδα θεώρησε ότι, σε σχέση με τους στόχους του πρώτου προγράμματος (1978 - 1981), οι πιστώσεις του προϋπολογισμού δεν ήταν ανάλογες με την έκταση και τον αριθμό των προγραμμάτων που υποστηρίχθηκαν.

Συστάσεις για μελλοντικά προγράμματα

1. Πρωταρχική σύσταση της ομάδας είναι ότι η ΕΚ θα πρέπει να συμφωνήσει πάνω σε μια σαφώς καθορισμένη εναρμονισμένη ευρωπαϊκή ερευνητική πολιτική για τις πρώτες ύλες ώστε να είναι δυνατή η διαμόρφωση στρατηγικής προοπτικής με έμφαση στη γενική διερεύνηση των δυνατοτήτων και τη μακροπρόθεσμη κοινοτική υπεροχή. Η ομάδα αναγνωρίζει τις

εγγενείς δυσκολίες ενός παρόμοιου έργου αλλά παρόλα αυτά θεωρεί το βήμα αυτό ουσιαστικό για τη τελική ανάπτυξη ανταγωνιστικής μεταλλευτικής βιομηχανίας στην Ευρώπη.

Η πολιτική αυτή θα πρέπει να περιλάβη :

- διεξοδική επανεξέταση με περιοδικό εκσυγχρονισμό των στρατηγικών συνεπειών από την προσφορά και τη ζήτηση πρωτογενών πρώτων υλών μέσα στην Κοινότητα,
- μελέτη των επιπτώσεων από τις μεγάλες αλλαγές στην αναλογία προσφοράς/ζήτησης, που επηρεάζουν διαρθρωτικά τον τομέα των πρωτογενών πρώτων υλών, καθώς επίσης και των βραχυπροθέσμων και μακροπροθέσμων σχετικών ενεργειών που θα πρέπει να αναλάβει η ΕΚ,
- μελέτη του προβλήματος της διατήρησης των τεχνικών γνώσεων στον τομέα της αναζήτησης και παραγωγής πρώτων υλών, που θα επιτρέψει στην ΕΚ να χρησιμοποιεί και να εξάγει προηγμένες τεχνολογίες,
- μελέτη των κοινωνικοοικονομικών συνεπειών για την Κοινότητα, συμπεριλαμβανομένων των περιβαλλοντικών αναγκών, από την ανάγκη να είναι περισσότερο αυτάρκης σε πρωτογενείς πρώτες ύλες,
- μελέτη για να εκτιμηθεί η θέση της Επιτροπής ως προς το συνολικό ρόλο της στον τομέα αυτό, δηλαδή θα πρέπει να δρα απλώς σαν καταλύτης - που σημαίνει να επαφίεται σε κυβερνήσεις ή οργανισμούς για να παρέχουν την κινητήρια δύναμη στον τομέα Ε και Α - και /ή να είναι υπεύθυνη δηλαδή να αναπτύξη η ίδια την ικανότητα να διευθύνει, να καθορίζει και να εκτελεί ειδικά προγράμματα σε πολυμερή / διεθνή βάση αλλά με κύρια επιδίωξη το κοινοτικό όφελος περισσότερο παρά ένα άθροισμα εθνικών ανταμοιβών.

2. Είναι επίσης ανάγκη να διαμορφώσει η Επιτροπή Ερευνητική πολιτική, προσδιορίζοντας το σχετικό βαθμό υποστήριξης που θα πρέπει να παρέχεται στη γενική κλιμάκωση της εμπειρογνωμοσύνης μέσα στην Κοινότητα σε αντιπαράθεση με τους τομείς άμεσης οικονομικής σημασίας όπου η αιτιολόγηση είναι πιο εύκολη.

   Τα μακροπρόθεσμα οφέλη από τη βελτίωση των θεμελιωδών τεχνικών θα μπορούσαν να είναι χρησιμότερα από την υποστήριξη ορισμένων πιο εμπειρικών τύπων προγραμμάτων που φαίνονταν τότε να δικαιολογούν άμεση χρηματοδότηση.

3. Η Επιτροπή θα πρέπει να εξασφαλίσει την επαρκή χρηματοδότηση μελλοντικών προγραμμάτων ώστε να ανταποκριθούν καλύτερα στους καθορισμένους στόχους.

Η ομάδα αναγνωρίζει ότι θα υπάρξουν περιορισμένα όρια σε σχέση με τις πιστώσεις του προϋπολογισμού αλλά συνιστά στην Επιτροπή να ακολουθήσει τη γενική πορεία διερεύνησης, που περιγράφεται παραπάνω σε γενικές γραμμές, με τη δέουσα προσοχή στις τρέχουσες προτεραιότητες.

RESUME

Aperçu politique et historique du programme

L'augmentation rapide des prix du pétrole brut au début des années 1970 a fortement influencé le marché des matières premières non combustibles. En même temps, l'important accroissement de la consommation mondiale a provoqué une hausse des prix de la plupart des matières premières essentielles come la bauxite, le phosphate, le cuivre, l'étain, le nickel, le chrome, le platine et le zinc.

La Commission a rédigé une proposition de programme de R&D pluriannuel dans le domaine des matières premières primaires (1978-1981) sur la base des recommandations des délégations nationales (COM(77)284). Une décision du Conseil a adopté cette proposition par laquelle était créé aussi le comité consultatif en matières de gestion de programme (6 mars 1978). Les activités du sous-comité CREST sur la R&D "matières premières" et le CCMGP ont été mises au point en coopération avec le secrétariat de la Division "Matières Premières" de la Direction Générale des Affaires Industrielles de la Commission, par le biais de la participation directe d'un représentant du secrétariat aux réunions des organismes consultatifs ci-dessus.

Les principaux objectifs du programme étaient :

- l'accroissement du potentiel d'auto-approvisionnement en matières premières de l'ensemble de la Communauté,
- la réduction des déficits de la balance commerciale,
- la mise au point et l'exportation de nouvelles technologies pour la prospection et l'exploitation des matières premières.

Le contenu technique du premier programme de R&D dans le domaine des matières premières était fondé sur la conviction que des ressources minérales pouvaient encore être découvertes sur le territoire de la CE sous forme de gisements cachés et/ou très profonds. En outre, il existe encore de vastes réserves inexploitées de minerais complexes ou de qualité inférieure et il faut aussi tenir compte du potentiel des gisements de qualité supérieure, mais de faible rendement.

Programme à l'étude (1978-1981)

Un groupe de gestion a été créé au sein de la DG XII pour la mise en oeuvre du programme et un comité consultatif (CCMGP) composé de représentants des Etats membres a aidé la Commission à exécuter le programme.

Un montant de 15,5 millions d'écus a été attribué aux 140 projects sélectionnés parmi 570 propositions faites.

Tous les contrats étaient à frais partagés (action indirecte), la Communauté prenant en charge 50% environ des coûts.

Le programme comportait trois grands domaines de recherche :

a) Prospection :
Recherche de gisements profonds ou cachés par
- sélection de cibles grâce à l'amélioration des connaissances en géologie appliquée,
- l'amélioration et le développement des méthodes de prospection.

b) Traitement du minerai :
R&D pour améliorer les techniques d'extraction et de traitement, notamment dans le cas des minerais de qualité inférieure ou complexes
- études de faisabilité et de modélisation,
- méthodes générales de traitement des minérais,
- développements spécifiques pour la lixiviation in-situ du cuivre, les sources alternatives d'alumine, les minerais plomb/zinc à grain fin (sulfures et oxydes), la chloruration et d'autres procédés appliqués aux minerais, à la gangue et aux résidus.

c) Technologie minière :
R&D sur les problèmes des gisements profonds et des gisements de minerais de qualité supérieure, mais de faible rendement
- technologies d'exploitation et de remblai,
- étude concernant les installations intégrées mobiles,
- inventaire de certains gisements européens.

Conclusions

En résumant les avis du groupe d'évaluation, on peut dire que les objectifs du programme ont été réalisés. La qualité technique des travaux faits dans le cadre du programme est d'un niveau élevé et témoigne de la compétence des contractants et du personnel souvent surchargé de la CE.

Toutefois, la portée des contrats était si vaste et les crédits, si faibles par rapport aux objectifs du programme que l'on pouvait s'attendre à première vue à un impact économique général assez limité. Néanmoins, l'effet de ce programme a été indiscutablement positif et les travaux effectués dans les différents domaines forment maintenant la base de développements futurs qui auront des répercussions importantes sur la découverte et la récupération des métaux et des matières premières.

L'intention déclarée au début du programme à l'étude était régie par les contraintes politiques et économiques qui existaient au moment des effets les plus néfastes de la crise du pétrole et qui, entretemps, ont changé de manière significative. Toutefois, le domaine des matières premières primaires est influencé plus fortement que d'autres par les fluctuations périodiques de l'offre et de la demande. Par conséquent, toute politique communautaire de recherche dans le domaine des matières premières doit tenir compte de ces circonstances et des perspectives à long terme qui en découlent.

Le groupe d'évaluation a estimé que, par rapport aux objectifs du premier programme (1978-1981), les crédits mobilisés n'étaient pas à la hauteur de l'ampleur et du nombre de projects soutenus.

Recommandations pour les programmes futurs

1. Le groupe recommande avant tout que la CE se mette d'accord sur une politique européenne cohérente et bien définie dans le domaine des matières premières, pour pouvoir adopter une perspective stratégique mettant l'accent sur les avantages à long terme pour la Communauté. Le groupe admet les difficultés inhérentes à cette tâche, mais estime néanmoins qu'elle est indispensable au développement ultime d'une industrie européenne compétitive des matières premières.

Cette politique doit tenir compte des éléments suivants :

- aperçu complet périodiquement mis à jour des incidences stratégiques de l'offre et de la demande de matières premières primaires dans la Communauté ;
- étude des effets des fluctuations de l'offre et de la demande affectant structurellement le domaine des matières premières primaires et des actions à court et à long terme qui devraient être entreprises dans la CE ;
- étude du problème de la conservation du savoir-faire dans le domaine de la prospection et de la production de matières premières, pour donner à la CE la capacité d'utiliser et d'exporter des technologies avancées ;
- étude des effets socio-économiques sur la Communauté, y compris les contraintes environnementales de la nécessité d'une plus grande autonomie dans le domaine des matières premières primaires ;
- évaluation de la position de la Commission quant à son rôle dans ce domaine : devrait-elle uniquement faire office de catalyseur et s'en remettre aux gouvernements ou organisations pour fournir les forces motrices dans le domaine de la R&D et/ou devrait-elle être responsable, c'est-à-dire développer elle-même la capacité de diriger, de définir et d'exécuter des projets spécifiques sur une base multilatérale/internationale, la considération essentielle étant l'avantage communautaire plutôt que l'agrégation des considérations nationales.

2. La Commission doit également formuler une politique de la recherche, en déterminant les niveaux relatifs de soutien à appliquer à la valorisation générale des compétences dans la Communauté, par opposition au domaine de l'importance économique immédiate, plus facilement justifiable. Les avantages à long terme de l'amélioration des techniques fondamentales pourraient être plus bénéfiques que le soutien accordé à certains types de projects empiriques qui, à l'époque, semblaient justifier un financement urgent.

3. La Commission devrait veiller à ce que les programmes futurs soient financés convenablement, pour correspondre davantage aux objectifs fixés. Le groupe admet qu'il existe des limites finies en ce qui concerne les allocations budgétaires, mais recommande à la Commission de poursuivre néanmoins les études et recherches générales esquissées ci-dessus, en tenant dûment compte des priorités établies.

RIASSUNTO

Sfondo politico e storia del programma

Il rapido rincaro del greggio registrato nel 1970 ed anni seguenti ha avuto violente ripercussioni sul mercato dei minerali non combustibili. Nel contempo l'importante aumento del consumo mondiale ha fatto esplodere prezzi della maggior parte delle merci molto richieste (come la bauxite, i fosfati, il rame, lo stagno, il nichelio, il cromo, il platino e lo zinco).

La Commissione ha redatto un progetto di proposta per un programma pluriennale di ricerca e sviluppo nel settore delle materie prime grezze (1978-1981) basato sulle raccomandazioni delle delegazioni nazionali (COM(77)284). Una decisione del Consiglio ha adottato questa proposta, con la quale venne designato anche il comitato consultivo di gestione del programme (6.3.1978). Le attività del sottocomitato CREST in materia di ricerca e sviluppo per materie prime e del comitato consultivo di gestione del programma sono state sviluppate in collaborazione con la segreteria delle materie prime dalla direzione generale degli affari industriali della Comissione mediante partecipazione diretta di un rappresentante della segreteria alle riunioni degli organi consultivi suddetti.

I principali obiettivi del programma erano :
- aumento del potenziale di autoapprovvigionamento di materie prime per la Comunità nel suo complesso ;
- riduzione dei disavanzi commerciali di pagamento ;
- sviluppo ed esportazione di nuove tecnologie per l'esplorazione e l'estrazione dei minerali.

I contenuti tecnici del programma di R&S sulle materie prime grezze si basavano sulla convinzione che era ancora possibile trovare risorse minerarie nel territorio comunitario in giacimenti nascosti e/o molto profondi. Per di più esistono ancora grandi riserve non sfruttate di minerali compositi o di qualità inferiore, senza contare il potenziale offerto da giacimenti di minerale di buona qualità ma di quantità meno rilevante.

Il programma valutato (1978-1981)

Un gruppo di gestione è stato costituito nella DG XII per porre in esecuzione il programma ed un comitato consultivo (CCGP) costituito da rappresentanti provenienti dagli Stati membri ha assistito la Commissione nell'esecuzione del programma.

Un importo di 15,5 milioni di ECU è stato messo a disposizione di 140 progetti selezionati fra 270 proposte.

Tutti questi contratti sono stati conclusi su una base di cofinanziamento (azione indiretta) : la Comunità ha sostenuto approssimativamente 50% delle spese.

Il programma comprendeva tre principali settori di ricerca :

a) Esplorazione :
   Ricerca di giacimenti situati a grande profondità o nascosti, mediante
   - la selezione dei siti ("target selection"), migliorando la conoscenza delle scienze geologiche applicate,
   - il miglioramento e lo sviluppo dei metodi di prospezione.

b) Trattamento del minerale :
   R&S per migliorare le tecniche d'estrazione e di trattamento soprattutto per i minerali di qualità inferiore e compositi
   - studi di modello e attuabilità,
   - metodi generali di trattamento del minerale,
   - sviluppi specifici di lisciviazione in situ per il rame, fonti alternative dell'allumina, minerali a grana fine di piombo/zinco (solfuri e ossidi), clorurazione ed altri processi applicati a minerali, scorie e residui.

c) Tecnologia mineraria :
   Ricerca e sviluppo in problemi riguardanti filoni profondi e giacimenti minerari d'alta qualità ma di quantità poco rilevante
   - tecnologie d'estrazione mineraria e di ricorpimento,
   - studi per impianti mobili integrati,
   - inventario dei gracimenti europei sicuri.

Conclusioni

Riassumendo i punti di vista del gruppo incaricato della valutazione si può affermare che gli obiettivi del programma sono stati raggiunti. La qualità tecnica del lavoro compiuto nel quadro del programma è pregevole, oltre adessere eloquente per quanto riguarda la competenza degli organismi contraenti e del personale comunitario talora eccessivamente sotto pressione.

Il raggio d'azione dei contratti tuttavia era talmente esteso e la quantità del fondi così scarsa rispetto agli obiettivi del programma che a prima vista l'impatto economico globale dovrebbe essere alquanto limitato. Tuttavia le ripercussioni del programma sono state decisamente positive e il lavoro compiuto in vari settori si è rivelato giovevole per ulteriori sviluppi che avranno importanti conseguenze sulla scoperta e il recupero di metalli e minerali. L'intento dichiarato nell'esordio del programma qui valutato era dettato dalle esigenze politiche ed economiche che prevalevano subito dopo i peggiori effetti della crisi petrolifera e che nel frattempo hanno cambiato di molto. Il settore delle materie prime grezze tuttavia, contrariamente ad altri, risente di più delle variazioni di grande ampiezza che si hanno nel rapporto domanda/offerta, che tendono a verificarsi periodicamente. Di conseguenza ogni politica di ricerca comunitaria sulle materie prime deve tener conto di queste condizioni e delle corrispondenti prospettive a lungo termine.

Il gruppo ha ritenuto che, in relazione agli obietivi del primo programma (1978-1981), gli stanzamenti sul bilancio non erano commisurati all'ampiezza e al numero dei progetti sostenuti.

Raccomandazioni per programmi futuri

1. La raccomandazione principale del gruppo è questa : la Comunità dovrebbe accordarsi per definire con chiarezza una politica di ricerca europea coerente sulle materie prime, in modo da permettere di formulare una prospettiva strategica basata particolarmente sui vantaggi a lungo termine della Comunità. Il gruppo riconosce le difficoltà inerenti a un simile compito, ma ritiene che tale passo sia indispensabile per lo sviluppo definitivo di un'industria mineraria europea competitiva.

Una politica del genere dovrebbe includere :

- una revisione periodica globale ed aggiornata delle implcazioni strategiche dell'offerta e della domanda delle materie prime grezze nella Comunità ;
- uno studio degli effetti delle variazioni molto pronunciate sul rapporto offerta/domanda, che hanno delle ripercussioni strutturali nel settore delle materie prime grezze, e delle azioni a breve e a lungo termine che dovrebbero essere intraprese dalla Comunità ;
- uno studio del problema della conservazione del know-how nel settore dell'esplorazione e della produzione di materie grezze necessario affinché la Comunità possa di utilizzare ed esportare le tecnologie avanzate ;
- uno studio degli effetti socio-economici sulla Comunità, incluse le coercizioni ecologiche collegati alla necessità di raggiungere una maggiore autonomia nel settore delle materie prime grezze ;
- uno studio di valutazione della posizione della Commissione sotto il profilo del ruolo che le spetta in questo campo, per stabilire cioè se debba agire soltanto da catalizzatore, facendo affidamento sui governi o sugli organismi per imprimere una direzione nel settore R&S, e/o se la Commissione debba essere responsabile, cioè sviluppare in se stessa la capacità di dirgiere, definire ed eseguire dei progetti specifici su una base multilaterale/internazionale, anteponendo però il profitto comunitario all'insieme delle considerazioni nazionali.

2. La Commissione dovrà inoltre formulare una politica di ricerca determinando i livelli di sostegno relativi che dovrebbero essere applicati al miglioramento generale dell'esperienza posseduta nella Comunità, da contrapporre ai più alletanti traguardi dell'interesse economico immediato. A lungo termine, il miglioramento delle tecniche fondamentali dovrebbe risultare ben più utile dell'appoggio di certi tipi di progetto più empirici che sembravano autorizzare un finanziamento urgente sul momento.

3. La Commissione dovrebbe assicurare un finanziamento adeguato dei programmi futuri in modo da soddisfare il meglio possibile gli obiettivi definiti. Il gruppo riconosce l'esistenza di limiti per quanto riguarda gli stanziamenti finanziari, ma raccomanda che la Commissione continui ciò nonostante lungo le grandi linee di ricerca esposte sopra, tenendo nel debito conto le priorità che si impongono.

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SAMENVATTING

Politieke achtergrond en geschiedenis van het programma

De snelle stijging van de prijzen van ruwe olie in het begin van de jaren '70 heeft de markt voor ertsen sterk beïnvloed. Tegelijkertijd heeft de grote toename van het verbruik in de gehele wereld een sterke prijsstijging veroorzaakt van de meeste van de belangrijkste produkten (met name bauxiet, fosfaat, koper, tin, nikkel, chroom, platina en zink).

De Commissie heeft een voorstel opgesteld voor een meerjarenprogramma voor O&O op het gebied van primaire grondstoffen (1978-1981) dat was gebaseerd op de aanbevelingen van de nationale afvaardigingen (COM(77)284). Dit programma is bij een besluit van de Raad vastgesteld ; tevens is bij dit besluit het Raadgevend Comité voor Programmabeheer opgericht (6 maart 1978). De werkzaamheden van het subcomité van het CREST voor O&O op het gebied van grondstoffen en het RCPB zijn opgezet in samenwerking met het Secretariaat vor grondstoffen van het Directoraat-generaal Interne Markt en Industrie van de Commissie door rechtstreekse deelname van een vertegenwoordiger van het secretariaat aan de vergaderingen van bovengenoemde adviesorganen.

De belangrijkste doelstellingen van het programma waren :
- uitbreiding van de mogelijkheden van de Gemeenschap als geheel om in haar eigen behoeften aan grondstoffen te voorzien ;
- vermindering van de tekorten op de handelsbalans ;
- ontwikkeling en export van nieuwe technologieën voor de opsporing en winning van ertsen.

De technische inhoud van het O&O-programma voor primaire grondstoffen was gebaseerd op de overtuiging, dat er op het gebied van de EG nog steeds minerale delfstoffen kunnen worden gevonden op verborgen en/of diepliggende vindplaatsen. Bovendien bestaan er nog steeds grote, nog niet geëxploiteerde reserves van ertsen met een complexe samenstelling of een laag gehalte en moet ook rekening worden gehouden met de mogelijkheden van vindplaatsen met een hoog gehalte, maar van beperkte omvang.

Het programma (1978-1981)

Voor de tenuitvoerlegging van het programma werd binnen DG XII een beleidsgroep opgericht en de Commissie werd bij de uitvoering van het programma ondersteund door een raadgevend comité (RCPB), dat bestond uit afgevaardigden van de Lid-Staten.

Er werd een bedrag van 15,5 miljoen Ecu gereserveerd voor 140 projecten, die zijn geselecteerd uit 270 voorstellen.

Alle contracten waren voor gezamenlijke rekening ; de Gemeenschap droeg ongeveer 50% van de kosten.

Het programma was verdeeld in drie belangrijke onderzoekgebieden :

a) Exploratie :
Onderzoek naar verborgen of diepliggende vindplaatsen door middel van
- selectie van boorplaatsen door verbetering van kennis op het gebied van de toegepaste aardwetenschappen en
- verbetering en ontwikkeling van prospectiemethoden.

b) Ertsverwerking :
O&O ter verbetering van technieken voor winning en verwerking, met name voor ertsen met een complexe samenstelling en een laag gehalte :
- uitvoerbaarheids- en modelonderzoek,
- algemene methoden voor ertsverwerking,
- specifieke ontwikkelingen voor uitloging van koper ter plaatse, alternatieve aluminiumoxidebronnen, fijnkorrelige lood/zinkertsen (sulfiden en oxiden) chlorering en andere processen voor toepassing op ertsen, slakken en residuen.

c) Mijnbouwtechniek :
O&O naar problemen op het gebied van diepgelegen vindplaatsen en vindplaatsen met een hoog gehalte, maar van beperkte omvang :
- technieken voor mijnbouw en opvulling,
- onderzoek naar complete verplaatsbare installaties,
- inventarisatie van bepaalde vindplaatsen in Europa.

Conclusies

Samenvattend is de werkgroep van mening dat de doelstellingen van het programma zijn bereikt. De uitstekende technische kwaliteit van de binnen het programma uitgevoerde werkzaamheden verdient alle lof en vormt een compliment voor de bekwaamheid van de contractanten en het soms sterk overbelaste EG-personeel.

Het werkgebied van de contracten was echter zo veel omvattend en het gefinancierde bedrag was zo laag in verhouding tot de doelstellingen van het programma dat op het eerste gezicht zou worden verwacht, dat de totale economische gevolgen nogal beperkt zouden zijn. Desalniettemin heeft het programma duidelijk een positieve uitwerking gehad en het is gebleken dat de op verscheidene terreinen verrichte werkzaamheden een bijdrage hebben geleverd aan verdere ontwikkelingen, die een belangrijke invloed zullen hebben op de winning en terugwinning van metalen en mineralen.

De bij de start van het onderhavige programma geformuleerde oogmerken zijn tot stand gekomen onder invloed van de politieke en economische beperkingen, die onmiddellijk na de ernstigste effecten van de oliecrisis bestonden ; inmiddels is de situatie aanzienlijk veranderd. Primaire grondstoffen worden echter sterker dan andere produkten beïnvloed door de grote variaties in de verhouding tussen vraag en aanbod die periodiek plegen op te treden.

Derhalve moet bij ieder onderzoekbeleid van de EG op het gebied van grondstoffen rekening worden gehouden met deze omstandigheden en de daarmee samenhangende vooruitzichten op lange termijn.

De werkgroep is van mening dat gezien de doelstellingen van het eerste programma (1978-1981) het gereserveerde bedrag niet evenredig is met het aantal ondersteunde projecten en het werkgebied daarvan.

Aanbevelingen voor toekomstige programma's

1. De belangrijkste aanbeveling van de werkgroep is, dat er binnen de EG overeenstemming dient te worden bereikt over een duidelijk omschreven samenhangend Europees onderzoekbeleid op het gebied van grondstoffen om

het mogelijk te maken een strategie met toekomstperspectief te ontwikkelen, waarbij de nadruk ligt op een brede opzet en voordelen voor de Gemeenschap op lange termijn.

De werkgroep ziet in welke moeilijkheden er aan een dergelijke taak zijn verbonden, maar is desalniettemin van mening dat zo'n stap noodzakelijk is voor de uiteindelijke ontwikkeling van een concurrerende delftstoffen industrie in Europa.

Bij een dergelijk beleid dient in overweging te worden genomen :

- een periodiek bijgewerkt uitgebreid overzicht van de strategische gevolgen van de vraag naar en het aanbod van primaire grondstoffen binnen de Gemeenschap ;
- een onderzoek naar de gevolgen van de sterke variaties in de verhouding tussen vraag en aanbod die structureel van invloed zijn op het gebied van de primaire grondstoffen en naar de maatregelen op korte en lange termijn die door de EG dienen te worden genomen ;
- een onderzoek naar het probleem van het behoud van technische kennis op het gebied van exploratie en produktie van grondstoffe, waardoor de EG de mogelijkheid wordt geboden geavanceerde technologie te gebruiken en te exporteren ;
- een onderzoek naar de sociaal-economische effecten binnen de Gemeenschap met inbegrip van de beperkingen die het milieu stelt ten aanzien van de noodzaak meer in de eigen behoeften aan primaire grondstoffen te voorzien ;
- een onderzoek ter beoordeling van de positie van de Commissie met betrekking tot haar rol op dit gebied als geheel, d.w.z. dient de Commissie uitsluitend te fungeren als katalysator, zodat zij afhankelijk is van de door regeringen of organisaties geleverde stuwkracht op het gebied van O&O en/of moet de Commissie verantwoordelijk zijn, d.w.z. zelf het vermogen ontwikkelen om specifieke projecten op een multilaterale/internationale basis te besturen, vast te stellen en uit te voeren, waarbij de belangrijkste overweging echter het profijt van de Gemeenschap is en niet een complex van nationale overwegingen.

2. De Commissie moet ook een onderzoekbeleid opstellen, en niveaux van steunverlening vaststellen die moeten worden toegepast voor een algemene verbetering van de deskundigheid binnen de Gemeenschap in tegenstelling

tot de gemakkelijker te rechtvaardigen projecten met onmiddellijk economisch belang. Een verbetering van de fundamentele technieken zou op de lange termijn wel eens meer profijt kunnen opleveren dan de ondersteuning van meer op de praktijk gerichte soorten projecten, waarvoor op dat moment een noodzakelijke financiering gerechtvaardigd leek.

3. De Commissie dient ervoor te zorgen dat er voor toekomstige programma's een adequate financiering is, zodat de vastgestelde doelstellingen in hogere mate kunnen worden verwezenlijkt. De werkgroep beseft dat er geen ongelimiteerde bedragen kunnen worden gereserveerd, maar adviseert de Commissie desalniettemin de hierboven geschetste grote lijnen aan te houden en daarbij te letten op de geldende prioriteiten.

EVALUATION REPORT

EXECUTIVE SUMMARY

Political Background and History of the Programme

The rapid increase in crude oil prices in the early 1970s strongly influenced the market for non-fuel minerals. At the same time, the major rise of worldwide consumption caused a price boom for most of the important commodities (namely bauxite, phosphate, copper, tin, nickel, chrome, platinum and zinc).

The Commission drafted a proposal for a multiannual R&D programme in the field of Primary Raw Materials (1978-1981) based on the recommendations of the national delegations (COM(77)284). A Council Decision adopted this proposal by which the Advisory Committee for Programme Management was also appointed (6 March 1978). The activities of the CREST sub-committee on R&D Raw Materials and the ACPM were developed in cooperation with the Secretariat of Raw Materials of the Directorate-General of Industrial Affairs of the Commission through direct participation of a representative of the Secretariat in the meetings of the above advisory bodies.

The main objectives of the programme were :

- increase in self-supply potential in raw materials for the Community as a whole ;
- reduction of trade payment deficits ;
- development and export of new technologies for the exploration and exploitation of minerals.

The technical contents of the primary raw materials R&D programme were based on the conviction that mineral resources are still to be found in the EC territory as concealed and/or deep-seated deposits. Moreover, there still exist large unexploited reserves of complex or low-grade ores, and one should also take into account the potential offered by high-grade low tonnage deposits.

Programme under Review (1978-1981)

A management group was established in DG XII for the implementation of the programme and an Advisory Committee (ACPM) comprised of representatives from the Member States assisted the Commission in implementing the programme.

An amount of 15.5 Mio ECU was allocated for 140 projects selected out of 270 proposals.

All of the contracts were on a cost-shared (indirect action) basis : the Community bore approximately 50% of the costs.

The programme comprised three main research areas :

a) Exploration :
Research for deep-seated or concealed deposits using
- target selection by improvement of knowledge in applied earth sciences,
- improvement and development of prospecting methods.

b) Ore Processing :
R&D to improve extraction and processing techniques particularly for low grade and complex ores
- feasibility and model studies,
- general ore processing methods,
- specific developments for copper in-situ leaching, alternative sources of alumina, lead/zinc fine grained ores (sulfides and oxides), chlorination and other processes applied to ores, slags and residues.

c) Mining Technology :
R&D in problems of deep deposits and low-tonnage high-grade ore bodies
- mining and backfill technologies,
- studies for integrated mobile plants,
- inventory of certain European deposits.

Conclusions

Summing up the views of the Panel it can be stated that the objectives of the programme have been met. The technical quality of the work done within the programme is of a commendably high standard and speaks highly for the competence of contracting bodies and of the sometimes very overstretched EC staff.

The scope of the contracts, however, was so all-embracing and the amount of funding was so low in relation to the aims of the programme that the overall economic impact would be expected, at first sight, to be somewhat limited. Nevertheless, the effect of the programme was decidedly positive, and the work done in several fields proved to be instrumental for further developments which will have a significant impact on the discovery and recovery of metals and minerals.

The stated intent at the outset of the programme under review was governed by the prevailing political and economic constraints that existed immediately following the worst effects of the oil crisis and that, in the meantime, have changed significantly. However, the field of primary raw materials, in contrast to others, is more strongly influenced by high amplitude variations in the demand/supply ratio that tend to occur periodically. Consequently, any EC research policy on raw materials has to take into consideration these conditions and the corresponding long-term prospects.

The Panel considered that in relation to the aims of the first programme (1978-1981) the budget allocation was not commensurate with the scope and number of projects supported.

Recommendations for future programmes

1. It is the prime recommendation of the Panel that the EC should agree on a clearly defined coherent European research policy on raw materials so as to enable a strategic perspective to be taken with the emphasis on overview and long-term Community advantage. The Panel recognises the

inherent difficulties of such a task but nevertheless considers such a move essential for the ultimate development of a competitive mineral industry in Europe.

Such a policy should consider :

- a periodically updated comprehensive review of the strategic implications of the supply and demand of primary raw materials within the Community ;
- a study of the implications of the high-amplitude variations in the supply/demand ratio structurally affecting the field of primary raw materials, and of the short-term and long-term related actions that should be taken by the EC ;
- a study of the problem of conservation of know-how in the field of exploration and production of raw materials, providing the EC with the capability to use and to export advanced technologies ;
- a study of the socio-economic effects upon the Community including environmental constraints of the need to be more self-sufficient in primary raw materials ;
- a study to evaluate the Commission's position in terms of its role in this field as a whole, i.e. should it merely act as a catalyst in that it would be reliant on governments or organisations to provide the driving forces in the R&D field, and/or should the Commission be responsible i.e. develop the capability within itself to direct, define, and execute specific projects on a multi-lateral/international basis but with the main consideration being the Community benefit rather than the aggregate of national considerations.

2. The Commission also needs to formulate a research policy, in determining the relative levels of support which should be applied to the general upgrading of expertise within the Community as opposed to the more easily justifiable areas of immediate economic importance. The long-term benefits of improving fundamental techniques could well be more beneficial than the support of some more empirical types of projects which appeared to warrant urgent funding at the time.

3. The Commission should ensure that future programmes are adequately funded in order to more closely satisfy the defined objectives. The Panel recognises that finite limits will exist with regard to budget allocations, but recommends that the Commission nevertheless pursue the general avenues of investigation, outlined above, with due regard to prevailing priorities.

ACKNOWLEDGEMENTS

The Panel gratefully acknowledges the kind help and positive attitude of the many people that were involved and helped in the preparation of this report.

First of all, the Panel would like to thank Mr. Bourdeau and his entire staff within the Directorate-General XII for their most valuable help in providing information on every subject connected with the programme, and generally making the meetings in Brussels a pleasant experience.

Thanks are also due to the chairmen and members of the various committees involved in the programme for giving their in-depth evaluation of the sometimes complicated background of the programme under examination, and to the contractors who willingly came to Brussels for further discussion and examination of their respective projects.

Special thanks go to Mrs. Spachis, from the Evaluation Service of DG XII, who sat with the Panel through all the sometimes demanding meetings, and who prepared detailed minutes of the proceedings in addition to taking care of all the small but important problems.

CHAPTER 1

1. INTRODUCTION

1.1. Political Background

The rapid increase in crude oil prices in the early 1970's strongly influenced the market for non-fuel minerals. At the same time, a major rise of world-wide consumption caused a price boom for most of the important commodities (namely bauxite, phosphate, copper, tin, nickel, chrome, platinum and zinc). All Western countries were concerned with ensuring adequate supplies for their manufacturing industries. In this time of shortage, the European Community feared the possible exercise of leverage by the producers of strategic minerals. This was a reason for political action. Thus, the Commission presented to the Council a paper on the raw materials supply situation and the measures that were taken or could be taken at Community level in this respect (COM(75)50).

A sub-committee of CREST (Comité de la Recherche Scientifique et Technique) was also established with the task of obtaining an overall view of the primary and secondary raw materials sectors and of determining the needs, if any, for joint R&D actions in this field. The sub-committee recommended initiation of technico-economic studies ("dossiers") for the following commodities : copper, lead/zinc, aluminium and phosphates (published in 1978 and 1979), and also identified a number of topics for R&D topics suitable for Community action in the field of primary raw materials.

1.2. History of the Programme

The Commission drafted a proposal for a multiannual R&D programme in the field of Primary Raw Materials (1978-1981) based on the recommendations of the national delegations (COM(77)284). A Council Decision adopted this proposal by which the Advisory Committee for

Programme Management was also appointed (6 March 1978). The activities of the CREST Sub-committee on R&D Raw Materials and the ACPM were developed in cooperation with the Secretariat of Raw Materials of the Directorate-General of Industrial Affairs of the Commission through direct participation of a representative of the Secretariat in the meetings of the above advisory bodies.

In addition, representatives of the management group of the R&D Raw Materials programme and the on-going MMS (Metals and Mineral Substances) regularly participate in the meetings of the working party on the Supply of Raw Materials Policy that operates for the purpose of developing a Community policy for Raw Materials.

A public call for proposals was published in the Official Journal of the European Community (O.J. n° C 10, 11.5.1978).

A complementary call was made for the second phase of the programme (O.J. n° 207, 12.8.1980).

1.3. General Objectives of the Programme (1978-1981)

The main objectives of the programme were :

- increase in self-supply potential in raw materials for the Community as a whole ;
- reduction of trade payment deficits ;
- development and export of new technologies for the exploration and exploitation of minerals.

The programme's objectives were intended to aim for practical results in the medium-term (especially in the areas of extraction, ore processing and mining technology where sites had already been identified) and in the medium to long-term (e.g. applied geology studies and the improvement of prospection methods).

Certain criteria were used for the selection of projects to be supported, in particular :

- completing or reinforcing current national R&D programmes,
- being consistent with the needs of industry in the Member States,

- involving, as much as possible, research groups from several countries which would cooperate in joint projects ,
- considering environmental and energy aspects.

The technical contents of the primary raw materials R&D programme were based on the conviction that mineral resources are still to be found in the EC territory as concealed and/or deep-seated deposits. Moreover, there still exist large unexploited reserves of complex or low-grade ores, and one should also take into account the potential offered by high-grade - low-tonnage deposits.

The programme therefore comprised three main research areas :

- Exploration

  Research for deep-seated or concealed deposits, using
  - target selection by improvement of knowledge in applied earth sciences,
  - improvement and development of prospecting methods.

- Ore processing

  R&D to improve extraction and processing techniques particularly for low-grade and complex ores
  - feasibility and model studies,
  - specific developments for copper in-situ leaching, alternative sources of alumina, lead/zinc fine grained ores (sulphides and oxides), chlorination and other processes applied to ores, slags and residues.

- Mining technology

  R&D for problems in deep deposits and low-tonnage - high-grade ore bodies
  - mining and backfill technologies,
  - studies for integrated mobile plants,
  - inventory of certain European deposits.

A management group was established in DG XII for the programme and an Advisory Committee (ACPM) comprised of representatives from the Member States assisted the Commission in implementing the programme.

An amount of 15,5 Mio ECU was allocated for 140 projects selected out of 270 proposals. Two catalogues with summary descriptions of the funded projects (cost-shared contracts) were published by the Commission in December 1979 and July 1981. Several contact groups and steering committees have been established (see Annex 4.1) in order to coordinate research groups and ACPM members. Meetings have been organized for the exchange of ideas.

Reports were required from contractors on a six-monthly basis and final reports were required at the end of the contract. At the end of the programme 127 final reports were received of which 73 were essentially on Exploration and 54 on Ore Processing and Mining Technology. A list of funded projects and resultant patents is given in Annex 4.2.

All of the contracts were on a cost-shared (indirect action) basis : the Community bore approximately 50% of the costs.

Several papers covering meetings and workshops have been published.

1.4. Outline of the On-going Programme (1982-1985)

The ACPM participated continuously in the exchange of preliminary results monitoring the progress of on-going research. Regular discussions at the ACPM, then at CREST Sub-committee level, concerning the situation of raw materials and worldwide developments prepared the ground for a continuation of the Community's efforts. A comprehensive new raw materials programme was recommended in 1980 including the sub-programmes on :

- Metals and Mineral Substances (MMS)
- Wood as a Renewable Raw Material
- Recycling of Non-Ferrous Metals
- Substitution and Ceramics.

The proposal (COM(81/281, 17 June 1981) for a second R&D programme in the Raw Materials Sector (1982-1985) was adopted by the Council on 17 May 1982 and a new call for proposals was published (O.J. n° L 174, 21 June 1982).

The objectives of the MMS sub-programme are similar to those of the first programme and the topics are identical, but with changed emphasis in some cases to adapt to evolving research needs.

An amount of 25 Mio ECU has been allocated for 130 contracts, most of them ending in 1985.

A preliminary list of funded projects (shared-cost contracts) with summaries of the technical contents was published in July 1983, and also proceedings of meetings and workshops have already been published. The list of funded projects is in Annex 4.3.

Encouraging preliminary results have been reported by the contractors in all three main topics.

1.5. Evaluation Methodology

1.5.1. Structure of the Evaluation Panel

The Commission of the European Communities (CEC), during the Summer of 1984, appointed a Committee of five independent experts, assigning to it the task of making an a posteriori evaluation of the Community's first R&D programme in the field of Primary Raw Materials (1978-1981). The partial results of the metal and mineral substances sub-programme of the current shared-cost action on raw materials (1982-1985) were also taken into consideration by the Panel.

This evaluation serves the purpose envisaged in the "Action Plan relating to R&D evaluation" adopted by the Council of Ministers on 28 June 1983. In this Council Resolution, external evaluations of Community supported R&D programmes should be carried out by independent experts with the view of contributing to the formulation of a more effective S&T policy and optimising the allocation of R&D resources.

The evaluation Committee and its Chairman were appointed by the Commission. The members of the Committee of different nationalities were selected on the basis of their experience and their expertise in the different topics covered by the programme.

List of members of the Committee :

Mr. Jean BOULADON Economic Geology	Ecole Nationale Supérieure des Mines de Paris, France
Prof. Dr. Peter M. BRÜCK Geology, Geochemistry	Geology Department University College, Cork Ireland
Prof. G. FERRARA Mineral Processing	Facoltà di Ingegneria Università di Trieste, Italy
Prof. Dr. Franz K. LIST Geology, Remote Sensing (Chairman)	Institute of Applied Geology Department of Remote Sensing Free University of Berlin Berlin, Federal Republic of Germany
Mr. K.J. SANGSTER Metallurgy	Technical Director RTZ Metals Ltd Bristol, United Kingdom

None of the members had played any role in the formulation or implementation of the programme to be evaluated. This report represents personal opinions and not those of the organizations to which these experts are connected.

1.5.2. Terms of Reference

The evaluation Panel was given the following terms of reference :

- to assess the scientific and technical achievements of the programme (quality and practical relevance of the results, possible spin-offs) ;

- to assess the contribution of the programme to Community objectives ;

- to assess the effectiveness of the management and coordination of the programmes including the operational structure ;

- to make recommendations, where appropriate, for the orientation of future programmes.

The findings of the expert team, their conclusions, recommendations and suggestions are laid down in this evaluation report.

1.5.3. Evaluation Methods and Procedures

The evaluation Committee held seven meetings between July 1984 and May 1985. To accomplish its task the following sources of information were used :

a) study of available documents (Annex 4.4)
b) preparation of questionnaires for the contractors of the first programme and analysis of the answers (Annex 4.5)
c) meetings with the chairman of the CREST Sub-committee on R&D Raw Materials and the chairman of the ACPM (Annex 4.6)
d) meetings with the programme management and talks with other EC officials whose work is relevant to the programme (Annex 4.6)
e) interviews of a number of selected contractors (Annex 4.6).

Considering the large number of projects within the programme, a selective policy was adopted for the evaluation procedure. This was accomplished by :

1. Subdividing the various topics among the Panel members according to their specialisation, involving studies of selected final reports.

2. A relatively broad survey of contractor's views by means of questionnaires sent to all contractors (see Annex 4.5 for sample questionnaire).

3. A selection of individual contracts for subsequent interviews based upon :
   a) representativeness within the topic field
   b) size and complexity of the project.

CHAPTER 2

2. EVALUATION OF SCIENTIFIC AND TECHNICAL RESULTS

The entire programme was divided into three main areas of investigation, namely :

- Exploration
- Ore Processing
- Mining Technology.

These major areas were further subdivided into topics as shown in the following sections.

2.1. Exploration

This field of activities was broken down as shown below with the relevant funding :

Topic 11 : Concealed and Deep-Seated Deposits

		ECUs
11.10	Types of deposits, environment of deposition, ore genesis	2,239,619
11.20	Mineralogy, petrology, geochemistry	666,059
	Subtotal	2,905,678

Topic 12 : Prospection Methods

12.10	Geochemistry	2,014,638
12.20	Geophysics	1,434,328
12.30	Remote Sensing	1,014,370
12.40	Drilling	127,400
	Subtotal	4,590,736
	Total Exploration	7,496,414

corresponding to 48.35% of the total budget

(see also Annex 4.7)

2.1.1. Topic 11 : Concealed Deposits and Deep-Seated Deposits in Europe

Scope of topics 11.10 and 11.20

33 projects were funded at a total cost of 2,905,678 ECUs which represents 18.7% of the overall expense for the Primary Raw Materials R&D programme, and 38.8% of the funds allocated to exploration.

The following research areas were covered by the projects :

- Volcanogenic and volcanosedimentary deposits : 7
- Deposits in sediments (carbonates and others) : 13
- Deposits linked with granites : 8
- Deposits linked with ultrabasic rocks : 5

The programme management gave the following overview of the projects in this topic :

007 F Much of the stratiform base metal mineralisation in the Palaeozoic of Europe belongs to the sedimentary hydrothermal type. This is far more widespread than the true volcanogenic model. It was necessary to define specific controls such as synsedimentary tectonics, palaeogeographic features and characteristics of sedimentary traps.

The results obtained in Brittany, in the Pyrenees and the North of Montagne Noire (S.W. Massif Central) provide useful guides for exploration, both on regional and local scales. New occurrences of ore were found.

This study supplemented a longer term investigation initiated in France.

008 F The objective was to develop a multi-approach methodology (sedimentology, stratigraphy, hydrogeochemistry, geophysics, ..) to detect deep concealed deposits of lead and zinc in the Mesozoic sediments fringing the Massif Central to the South and South East. This approach has proved most successful in drawing attention to new sectors of potential interest and thus highlights the merits of pluridisciplinarity in mineral exploration.

009 F The discovery of deep-seated deposits in Mesozoic sediments surrounding outcrops of Palaeozoic basement requires knowledge of basement topography and of facies variations in sediments, to be confronted with metallogenic data. The investigation was carried out around the Massif Central. Although knowledge remains fragmentary in some areas, a prospective sector was delineated near the Morvan, and this positive result appears to justify the type of approach used.

080 F See details in section on interviews.

122 F (Joint project with 121 UK and 123 DK). This was an important project aimed at refining our understanding of chromite mineralisation in ophiolites, with special emphasis on aids to mineral exploration. Investigations were carried out on well-known ophiolites (Oman, Vourinos, New Caledonia) which could provide areas for case studies, and extended into the second programme (MMS). Emphasis was on magmatic features, structural geology, whole-rock and mineral geochemistry. Geophysics were also studied (contract 124 D). Results were presented in April 1985 at an IMM conference on the metallogeny of basic/ultrabasic rocks. This work is having spin-off in platinoïds research under the MMS programme.

090 I This project has improved our knowledge of the geologic setting of copper and other base metals mineralisation in the Silurian of Central Sardinia, particularly in the vicinity of the Funtana Raminosa mine.

091 I This project comprised an investigation of the sedimentology, mineralogy, petrology and geochemistry of selected sections across the Cambrian Carbonates of S.W. Sardinia. Although this is a classic mining district for lead and zinc ores, knowledge of the geological setting was far from adequate. Some progress has been made. Much remains to be done however, and the topic has been taken up again in the MMS programme in conjunction with an investigation of the related district of Southern Montagne Noire in France.

157 I This was a much needed and useful, but finally disappointing (from an economic point of view), study on the potential for phosphate rocks in S.E. Sicily. The phosphate-bearing horizon is not very substantial, grades remain low, and preliminary enrichment tests have been more or less negative.

092 I (160 I) The EC contribution here was to provide means to synthesize and finalize data from an important effort of research which had been on-going for several years in the Permo-Triassic sediments of the Eastern Italian Alps. As a result and after completion of the contract, new ideas have been formed on the Salafossa lead/zinc deposit. It is hoped that they will lead to the discovery of extensions of the mine.

142 NL This was a comparatively minor project aimed at quantifying mass exchanges between the Seriphos granodiorite (Greece) and its country rocks where mineralized contact skarns are observed.

031 B This project sought to investigate the possibility that shale hosted or Mississipi-valley-type deposits of lead and zinc can exist in the Palaeozoics of Belgium.

Palaeogeography as well as lithogeochemistry have indeed pointed to a number of interesting features, but this remains a long-range approach. Complementary research is being done under an MMS contract in cooperation with BRGM and the Heidelberg University.

143 B This study has nicely pointed to a possible genetic relationship between scheelite concentration in calc-silicate gneiss of the Tanneron massif in S.E. France (deposit of La Favière), and the phenomenon of partial melting in high-grade metamorphic rocks. It is being taken up again in the frame of a large scale European venture on tungsten deposits, as part of the MMS programme.

039 UK This project involved an investigation and demonstration of the mineral potential of a large but low-grade body of apatite-bearing pyroxenite in the Loch Borrolan complex of Scotland (5 million tonnes of apatite down to a depth of 100 m, assuming an average grade of 2% P_2O_5). Grade is too low for economic exploitation, but preliminary beneficiation tests have been encouraging.

040 UK This was an investigation on the structural, geochemical and lithological setting of the Morfa Du copper sulphide body in the Parys Mountain deposit of Anglesey.

042 UK As a result of work carried out in the vicinity of the granite outcrop in S.W. England, it is confirmed that changes in the reflectivity of vitrinite in weakly metamorphosed shales may indicate the presence of granite cusps at some depth, and of granite dykes.For routine use, the technique is heavily dependent on the availability of suitable samples at a low cost and on sufficient quantities of organic matter.

043 UK See details in section on interviews.

148 UK The study was limited to a preliminary investigation to find out whether meaningful analyses can be obtained on cuttings from oil exploratory drill-holes, i.e. if possible contamination effects of drilling muds can be overcome. Results appear to have been positive, but the main question ("evaluation of the base metal potential of sedimentary basins on oil-wall sampling") has not really been addressed.

149 EIR The objective was to examine the concept of "fertile" and "barren" basement regions to Palaeozoic base metals deposits on both sides of the proposed Iapetus suture in Britain and Ireland, and subsequently to ascertain the contribution from host rocks by scavenging aqueous solutions during the formation of volcanoexhalative base metal deposits. This was in fact an ambitious investigation, to be undertaken on the scale of the whole Caledonides, and concrete results are still awaited. The EC contribution was limited only to one year.

077 DK This comprised investigations by a mining company on several types of scheelite mineralisation in East Central Greenland. A potential area has been delineated at Ymers ø (E Greenland) but the outcropping high grade mineralisations have been deeply eroded. Therefore, further research must be concentrated on buried mineralisations.

105 D This study of Lower Devonian concretions in the Rheinisch Schiefergebirge has shown that they are genetically related to acid volcanism, but they do not represent distal carbonates or cherts of stratiform sulphide deposits. Their value as guides to ore concentrations is therefore limited.

106 D The objective was to simulate hydrothermal mineralisation by performing on granitic rocks a series of experiments involving intermediate oxidized sulfur species (I.O.S.S.).

Participation of I.O.S.S. in dissolution, transports, replacement of wall rock, precipitation of sulphides and sulfates, was investigated.

081 F This study was a demonstration on the mineralized district of Melle (W. France), of connections between lead/zinc mineralisation, and of silicification and karstification in Jurassic limestones.

030 B - 110 B - 111 B

These comprised three coordinated contracts on the investigation of new geochemical metallotects in carbonate environments.

030 B The aim was to find out to what extent the presence of a carbonate-hosted lead/zinc deposit could be detected by variations in the chemical composition of the textural components of the different microfacies. Despite interesting results, the applicability of this approach in prospecting seems doubtful.

Investigations were also undertaken on limonitic fragments present in soils over carbonate rocks, and representative of subsurface gossans.

110 B Lead isotope studies on galenas from veins emplaced in the Devonian and Lower Carboniferous of Belgium have shown that the middle and upper Devonian limestones and shales constitute the source for most of the metallic content of the veins.

111 B The objective here was to investigate the usefulness of trace element geochemistry of minerals (spathic calcites, iron sulfides) as well as of fluid inclusions in spathic calcites as proximity indicators of lead/zinc deposits in carbonate environments. Despite a wealth of new data (mostly published), no clear-cut conclusion was reached for practical use.

038 UK Fluid inclusion studies have confirmed, particularly at Carrock Fell (N. England) that with proper geological control it is possible to delineate potentially mineralised areas by examining various features of the inclusion chemistry in quartz veins. Ore-bearing and barren quartz veins can be differentiated. Fluid inclusion Rb-Sr isochrons have also been obtained in several environments, notably S.W. England, and testify to the wide range of possibilities offered by those methods.

041 UK As a result of this project, fluid inclusion maps showing the reginal abundance and distribution of inclusion types are available for all S.W. England granites. Certain regional or local anomalies can be related to areas of known mineralisation or intense hydrothermal alteration. Overall, fluid inclusions show a higher abundance for the S.W. England granites than for unmineralised or weakly mineralised granited elsewhere in the United Kingdom.

A fast and relatively low cost method to determine trace element geochemistry of the inclusion fluids has been developed, using ICP emission spectroscopy.

144 UK A model is proposed relating mineralisation in the red beds of the Triassic of Central England to processes of diagenesis. Diagenetic features such as the nature of cementing materials and others can be important to examine in mineral exploration.

067 EIR
126 EIR The aim was to investigate the genesis of both the Avoca Ordovician volcanogenic copper deposit and the sulphide mineralisation on the margin of the late Caledonian Leinster granite, by using stable isotopes. In fact, it appears that all the base metal deposits studied may have shared the same source of sulphur and metals. Metals may have been present in the Cambro-Ordovician strata and

concentrated by later heating events. The extent to which those interesting results can be used in exploration remains a rather open question.

The following contracts were selected by the Panel for closer study of the final reports : 043 B, 105 D, 123 DK, 126 EIR, (067 EIR), 008 F, 080 F, 032 UK, 039 UK, 041 UK, 043 UK, 121 UK.

Two of these contractors were invited for interviews (080 F and 143/121 UK).

- Contract 080 F : "A comparative study of tungsten-bearing skarns in the Pyrenees : structural and geochemical controls of mineralization, dynamics of metasomatism"
  . Contractor : Armines
  . Duration : 3 years
  . EC contribution : 400,000 FF (69,400 ECUs).

  The project was aimed at comparing barren skarns and scheelite-bearing skarns from 3 standpoints : stable isotopes geochemistry, major and trace elements geochemistry, structural features (tectonic traps). According to investigations made in the Pyrenees on 4 mineralized and 2 barren sites, geochemical signatures and structural controls are indeed specific for mineralized skarns.

  Refined geochemical work - such as O, C and S isotope analyses in silicates, carbonates and sulphides - can be applied in practice as a means of selecting prospects of tungsten-bearing skarns. This selection should take place after an initial phase of drilling, when fresh drill-core samples and some basic information on the deposit have become available. It is aimed at eliminating the prospects of least potential interest.

- Contract 043 UK : "The chromite of the Shetlands ophiolite : an appraisal in the light of new theory and techniques"
  . Contractor : The Open University, Milton Keynes
  . Duration : 2 years
  . EC contribution : £ 27,100 (40,000 ECUs).

- Contract 121 UK : "Determination of the factors controlling chromite mineralization, with special emphasis on aids to mineral exploration"
  . Contractor : The Open University, Milton Keynes
  . Duration : 2 years (extended into MMS Programme)
  . EC contribution : £ 35,823 (52,900 ECUs).

Contract 121 UK was associated with contracts 122 F (BRGM), 123 DK (University of Copenhagen) and 124 D (University of Hamburg) to determine "factors controlling chromite mineralization, with special emphasis on aids to mineral chromite exploration". Test sites were in Oman, Greece and New Caledonia (Global EC contribution for this group of four contracts was 356,800 ECUs).

Before the conception and start of this multinational project, research was initiated on the chromite ore bodies of the Shetland islands (contract 043 UK). The project demonstrated the ophiolite setting for this mineralisation. The final report contains a detailed description of the ophiolite and of its structure, as well as petrological and geochemical data on the chromites and their host rocks.

Some grains of platinum-group-metals had been identified in the course of the initial contract. Research is continuing under an MMS contract and has already produced important results. Unusual grades of PGM's and gold have been revealed, attracting much interest from mining companies.

Synopsis of responses from questionnaires

32 questionaires were sent out to this group. The following synopsis is based on comments from 9 questionnaires returned, corresponding to 27% of the contractors.

All of them felt that the programme enabled them to expand their already existing research capacity ; no new facilities were created. All of them, also, were able to acquire additional funding as a direct result of the EC programme.

Due to the relatively small project funds, few profesionnal researchers could be employed. In this case, a maximum of 4, and more commonly 1 or 2 researchers were working on the projects.

Cooperation with other institutions was one of the motivating forces along with the fundamental scientific reasons for applying for funding.

Most contractors were unable to keep to the originally agreed time scale, but felt that the nature and quality of the results did not suffer unduly. The main reason for the timing delays was considered to be the acquisition of equipment rather than of personnel.

Most researchers agreed that there were considerable side benefits to the programme mainly in respect to establishing new contacts, both within and outside the direct field of research.

The researchers were critical of both the timing, and to a lesser extent, the methodology of the call for tenders and the letting of contracts. Most researchers, however, thought that the monitoring and follow-up of the contract by EC personnel was satisfactory. Most contractors felt that the EC should put more emphasis on international collaboration and exchange of information.

Most researchers in this group felt that dissemination of information was adequate.

The contractors generally felt that their immediate contacts with the scientific and administrative staff of the EC were quite satisfactory.

As far as the level of funding is concerned, most contractors thought the 50/50 formula to be satisfactory in broad terms but remarked on the difficulties of acquiring sufficient money during the initial stages of the contract, particularly with regard to the setting up costs primarily related to equipment. In addition there seemed to be excessive delays even with regard to the agreed progress payments.

It was felt that EC should take more initiatives in two fields, one being the systematic publication of contract results (at least in terms of a condensed final report on all of the contracts), and the other being a strengthening of cooperation in its widest sense.

2.1.2. Topic 12 : Improvement and Development of Prospecting Methods and Techniques

This field of activities is subdivided into

- topic 12.10 Geochemical Methods : 22 projects
- topic 12.20 Geophysical Methods : 21 projects
- topic 12.30 Remote Sensing : 9 projects
- topic 12.40 Drilling Techniques : 2 projects

2.1.2.1. Topic 12.10 : Geochemical Methods

There was necessarily some degree of overlap between topics 11.00 and 12.10. On the one hand, some projects under 11.00 (particularly those on carbonates) included research on lithogeochemistry (examples : contracts 030 B, 031 B, 110 B, 111 B) ; on the other hand, projects on lithogeochemistry in topic 12.10 included investigation on general geology (e.g. contracts 107 D and 117 D).

22 projects were funded at a total cost of 2,014,638 ECUs which represents 13% of the overall expense for the Primary Raw Materials R&D programme, and 26.9% of the funds allocated to Exploration.

The following research areas were covered by the projects :

- Detailed geochemical prospecting methods : 7
- Regional geochemical prospecting : 5
- Study of volatiles/soil gases : 3
- Hydrogeochemistry : 3
- Dispersion halo studies : 2
- New analytical methods : 2

An overview of the projects was given by the programme management as follows :

001 D See comments in section on interviews

107 D See comments in section on interviews

109 D All the relevant information on the geological, structural and general setting of known antimony mineralisation in Tuscany was processed statistically and used to define areas of varying probability. Those areas of high probability were then sampled for geochemical tests. Further exploration was subsequently recommended on some sites.

The project was run in collaboration with contract 120 I, the object of which was to synthesize geological knowledge on the region.

117 D This study was intended to derive proximity indicators for massive sulfide deposits from the determination of primary dispersion patterns, including alteration haloes in volcanic and/or sedimentary host rocks. Test sites were selected in the East Pontides of Turkey, in the Iberian pyrite belt of Spain (where the most significant results for this EC programme were obtained) and in Sardinia. It involves extensive collaboration between a major laboratory and a University (F U Berlin) and is now

extended in the current MMS programme to include cooperation with the University of Ferrara for studies in the Carnic Alpes.

Apparently reliable geochemical indicators have been defined, particularly on the Spanish occurrences.

013 F The research was based on the belief that chemical mapping, as contrasted with petrographic or structural mapping, of facies in granites can reveal internal structures (zonal variations or magmatic pulses) and be correlated with metallogenic affinities. This approach has been tested on Hercynian granitoids, producing a new classification. Its practical impact still has to be ascertained.

083 F + 032 B)
084 F + 034 B + 113 I)
085 F) see section on interviews
087 F)
088 F)

051 UK The significance of As, Sb, Bi, Se and Te as pathfinder elements for mineral deposits was assessed in soils and stream-sediments for a number of geological situations and for various types of deposits, and was often found to be very good. A detailed discussion is provided.

072 EIR This study was intended as an extensive investigation on the lithogeochemistry of Lower Carboniferous sediments in Ireland. The project ran at first into some problems due to contamination of stored drill-core material. It was subsequently carried out to a point where preliminary results seemed to encourage further research. This has been taken up again under the MMS programme, and very promising implications for exploration in this difficult terrain of Central Ireland are beginning to emerge.

078 DK This study involved an investigation on the use of advanced computer graphic and multivariate statistical methods in a well-exposed area of Greenland for which there were available only a limited number of samples collected with varying density.

056 GR Final report not yet available.

033 B This investigation of primary geochemical dispersion patterns in the Dinantian carbonate rocks of Belgium has revealed distinctive features
1) on a regional scale in mineralized basins,
2) on a local scale in types of dolostones which are associated with mineralisation and in fault zones (printing effect by mineralizing solutions). Lithogeochemistry can therefore be used as an exploration tool for base metals even when the ore deposits are epigenetic. Factors such as sedimentary environment, lithology, paleogeography and diagenesis have been assessed. Interesting areas for further prospecting in Belgium are suggested.

045 UK (to be considered along with 001 D and 088 F) see section on interviews.

An important aim of this project on soil gas geochemistry was to evaluate effects of meteorological factors on soil gas distribution. A portable equipment for in-situ determination of CO_2 and O_2 was produced and extensively tested. Investigated gases included sulphur components and radon. Gas geochemical methods are claimed to be rapid.simple field techniques and provide useful adjuncts to the methods normally available in exploration (a conclusion still somewhat disputed by a number of exploration geologists).

135 F The EC contribution funded the final stages of an important investigation on gossans (supergene textures and their geochemical interpretation), which has led to significant cooperation with non European institutes, particularly in Australia (CSIRO).

025 NL Pronounced lithogeochemical anomalies of tungsten and accompanying tin have been detected in granitoid source rocks of Portugal (Panasqueira i.a.) and in the surrounding country rocks, together with the anomalies of other element coeval with the W-Sn mineralizing processes.

Statistical procedures were applied to reveal inter-element relations and contour maps of single element and factor scores were prepared. At Panasqueira in particular, those techniques appear capable of localizing mineralization, even when concealed under shales.

The following projects were selected for a closer study of the final reports : 001 D, 107 D, 083 F, 084 F, 088 F, 045 UK, 072 EIR. Three contractors (projects 001 D, 083 F and 107 D) were interviewed.

- Contract 001 D : "Development and application of a geochemical exploration method using volatile elements"
  . Contractor : BGR Hannover
  . Duration : 3 1/2 years
  . EC contribution : 645,000 DM (253,700 ECUs).

  The aim was to study the use of volatiles as a prospecting tool ; in particular mercury and sulphur gases, although other gases were also studied (He and Hydrocarbons). Gases were measured both in the field and laboratory (from soil samples). Much of the project has been carried out on glaciated terraines including Ireland and parts of Continental Europe e.g. Bavaria.

As from an early stage collaboration took place between BGR, BGs and BRGM. In general, sampling depth was about 1m ; although some deeper samples were also obtained.

Positive progress was made in the development of mercury and sulphur gas analytical methods in the laboratory. In addition, the collaboration with other researchers was highly satisfactory and the results will be published in scientific journals.

- Contract 083 F : "Improvement of geochemical prospecting techniques by means of phase selection"
  . Contractor : BRGM, Orléans
  . Duration : 2 1/2 years
  . EC contribution : 520,000 FF (90,200 ECUs).

This project was aimed at refining the techniques of classic soil and stream sediment surveying. It was carried out jointly with Université Catholique de Louvain (contract 032 B), and this collaborative aspect of the work can be described as exemplary. Main test areas were in the Ardennes and the Massif Central.

Other projects involving BRGM covered such topics as :
- enhancement of geochemical anomalies after elimination of influences (lithology, pedology, analytical procedures) which control levels of geochemical responses in survey work (087 F)
- soil gas geochemistry (088 F. See above the comments on 001 D)
- hydrogeochemistry (084 F)
- refinement of multi-element analytical techniques (085 F).

The best results were obtained with project 083 F/032 B. Project 087 F seemed rather unpromising at first but has developed later, after completion of that contract, in an interesting way. On hydrogeochemistry, one should again stress the good collaboration of several partners : BRGM, the Universities of Antwerp (034 B) and of Cagliari (113 I). Results on this latter topic can seem incomplete, however techniques of hydrogeochemical prospecting at least of lead and zinc are claimed to be ready for use on a routine basis.

The other projects were not so successful. One should mention, however, that work on soil gases, which is a difficult topic, has been extended in the MMS programme for all three partners (BGR, BGS, BRGM).

The classic stream sediment studies yielded the best results ; the other techniques particularly hydrogeochemistry proved to be of less value. The cooperative side of the programme worked well and the work is to be published.

- Contract 107 D : "Prospection of stratabound sulphide mineralizations in the Western part of the Rheinische Schiefergebirge"
  . Contractor : Rheinisch Westfälische Hochschule, Aachen
  . Duration : 3 years
  . EC contribution : 336,500 DM (132,200 ECUs).

The aim was to carry out
- lithogeochemical dispersion studies in Devono-Carboniferous rocks of the Venn Anticline and Inde Syncline and
- secondary dispersion studies in Devonian strata of the Eifel Syncline.

The work was initially a cooperative study with BGR ; other cooperation took place with Belgian, French, British and Irish teams. A large number of rocks, stream sediments and soils were analysed.

Significant anomalies were found using these methods - including hydrogeochemistry. The results have led to drilling programmes currently being carried out and the work has been presented at several conferences.

Synopsis of responses from questionnaires

22 questionnaires were sent out to this group.

This synopsis is based on comments from 15 questionnaires returned, corresponding to 68% of the contractors.

Most of them felt that the programme enabled them to expand their already existing research capacities, while 30% of them considered that the programme allowed them to create new facilities.

Most of the contractors were able to acquire additional funding as a direct result of the EC programme.

Again, a maximum of 4, and more commonly 1 or 2 researchers could be employed under this programme.

As before, the desire for increasing the level of multinational contacts was, along with the fundamental scientific interest, the main motivation factor for applying for funding.

In this area, there were no particular problems with maintaining schedules. Also, the original objectives were considered to have been largely achieved.

No specific side benefits were reported by this group.

Most contractors were critical of timing delays in the initial stages of the project involving the call for tenders and the letting of contracts. Monitoring and follow-up of the contracts by EC personnel was deemed satisfactory. Most contractors felt that the EC management did a good job in respect to promoting international collaboration and exchange of information.

In terms of the immediate contact with the scientific and administrative staff of the EC most researchers expressed their satisfaction.

The contractors were almost equally divided over the level of overall funding between regarding the present 50/50 formula as satisfactory, and considering the level as too low for this type of research.

In the opinion of the researchers, the EC should take more initiatives in the formal publication of contract results.

2.1.2.2. Topic 12.20 : Geophysical Methods

21 projects were funded at a total cost of 1,434,328 ECUs which amounts to 9.3% of the overall expense for the Primary Raw Materials R&D programme, and 19.1% of the funds allocated to exploration. The following research areas were covered by these projects :

- Airborne techniques : 2
- Ground techniques : 10
- Bore-hole techniques : 8
- Laboratory methods : 1

An overview of the 21 projects was given by the programme management as follows :

The objectives set for this topic were :

- to achieve methodological improvements which could result in obtaining more reliable data with a higher resolution and using less time consuming techniques ;
- to refine data interpretation technique ;
- to achieve methodology improvements through the use of new technologies.

Main selection criterion for the ACPM and the Commission services was to contract out studies that were scientifically sound and could advance the exploration technology.

- Airborne techniques

073 EIR — Industry was interested in this contract. The tests were successful and proved that the methods applied (electromagnetics, magnetics and scintillometry) could yield useful results on geology and distribution of electric parameters even in an area of highly conductive overburden. However, the penetration depths were less than expected.

137 F — The interpretation techniques developed by BRGM using aeromagnetic data of a survey over Brittany led to a successful procedure in differentiating between different types of anomalies (man-made or other).

- Ground techniques

MPP 124 D — A project on chromite exploration. It gave interesting results through which a certain differentiation is made possible between chromite ores and other rocks although the recorded differences in gravity are extremely low.

012 F — Multiprocessing methods of geophysical data which the CGG presently uses as a current interpretation technique.

082 F — The objective was to improve an electromagnetic apparatus. The research was successful in that it is producing now highly reliable data. The apparatus has not been commercialised although there was a potential for industrial use. The apparatus has been developed by a University and this may explain the difficulty in penetrating the market.

118 NL A project on "high resolution mining seismics" : Research on this topic is carried out only by 2-3 groups in the Western world. The method is feasible provided the overall noise is low. The application of the method in a border region of Germany was less successful due to poor reflection coefficients but proved very efficient over a coal mining area.

069 UK A study on the use of high resolution seismic reflection (HRSR) for determining the structure in Irish carbonate rocks. Major difficulties were encountered in data processing and in the field survey.

46 UK A study of induced polarization decay curves with positive conclusions and correct interpretation of data.

47UK/153UK Research into the use of computers in geoscience ; use of remote computers and use of field-based microcomputers. The use of remote computers did not prove feasible mainly because of delays during data transmission. The contract on the use of field-based microcomputers developed a management programme through which field data are transformed into forms where interpretation is possible. This field-based microcomputer system proved quite successful and was presented in several international meetings.

49 UK An evaluation of the TEM (Transient electromagnetic) equipment potential for studying the geological environment in Europe (already in use for 15 years in U.S.A., Canada, Australia, etc.). Promising results, extended to the second programme.

- Bore-hole techniques

086 F, 044 UK, 146 UK, 010 F
in cooperation with 102 F, 103 F.

146 UK Development of a very low frequency probe. It was designed to detect the three components of the electromagnetic field generated by very low frequency transmitters. The first prototype built in the laboratory worked very reliably and it is possible to use presently this technique. There is no similar probe available commercially.

010 F The research work is carried out in cooperation with the Centre de Recherches Nucléaires (contr. n° 103F) and the Centre National de Recherche Nucléaires (contr. n° 102 F). This programme has been extended to the second MMS programme. Since the production of an appropriate neutron generator was stopped in the early phase of the programme, a prototype probe using a 10 cm in diameter generator was successfully tested in the field and laboratory work was mainly concentrated on analytical studies.

011 F Based upon this work of BRGM a new detector was developed, commercialised recently under the name of SYRANO ; the instrument is used extensively by the mining industry.

General results of all the contracts described have been published in various international journals. In the "Transactions of the Institute of Mining and Metallurgy" (vol. 94, February 1985, section B) the R&D results of some of the contracts in this topic were described in detail together with a summary concerning all geophysical projects.

- Laboratory methods

147 UK One project dealt with the applicability of thermoluminescence for mineral exploration. Actually, this is a laboratory method used by mineralogists and not, strictly speaking, a geophysical method. It was found that thermoluminescence, both natural and artificially induced, reflects the mineralogical composition of a given rock, and not a kind of a fossil thermal anomaly. Eventually, when using only quartz thermoluminescence, some information on alteration zones or hydrothermal anomalies could be deduced.

As a consequence of the overview given by the programme management, one contractor (073 EIR) was invited for an interview.

- Contract 073 EIR : "Aeromagnetic study of the structural control of mineralization in Central Ireland, between latitudes 52N-54N with the object of identifying economic targets.
  . Contractor : Geological Survey of Ireland
  . Duration 2 1/2 years
  . EC contribution : Ir £ 255,260 (376,700 ECUs).

  The objective was to obtain aeromagnetic data over the central part of Ireland where the bedrock consists of carboniferous limestone that contains economically interesting Pb-Zn mineralization. Most of that area is covered by Quaternary deposits and bogs so that geophysical methods are necessary in order to further the geological knowledge of that region. The contract comprised three phases : Aeromagnetic survey, compilation of maps of the total magnetic field, and interpretation of the results with respect to structural control of the mineralised zones.

  The project proceded according to plan apart from delays caused by adverse weather conditions. The contract used conventional geophysical data acquisition and data interpretation methods in

order to fill in the basic knowledge of an area with potential economic mineral occurrences. The results have led to new insights into the geology of central Ireland, and already several mineral exploration companies have taken out new ground under licence. Future benefits are to be expected when new field data will have led to a re-interpretation of the new aeromagnetic data. This process will go on for several years to come.

Synopsis of responses from questionnaires

21 questionnaires were sent out to this group.

This synopsis is based on comments from 13 questionnaires returned, corresponding to 62% of the contractors.

Most researchers (which were predominantly government institutions) felt that the funding they received in the context of this programme enabled them to create new research facilities. It also helped them to attract additional funds as a direct result of the EC programme.

Again, comparatively few people (1 to 4) could be employed under this programme.

The main motivating factor for the application for participation in this programme was the desire to develop new methods which could not have been funded otherwise.

Most researchers reported considerable delays in initiating the contract, primarily as a result of the lack of capital funding to cover establishment cost.

This group was of the opinion that the contract management experience in itself was a significant side benefit.

Most of the contractors considered all the phases of contract management as satisfactory.

The immediate contact with the scientific and administrative staff was reported as being generally satisfactory but it was felt that the administrative sector in particular required more staff to handle the considerable workload.

The level of funding was considered as too low in most cases, and should be variable, particularly with regard to projects requiring high levels of capital funding.

The group felt a distinct need for the EC to take more initiative in promoting symposia and organizing publication provisions for contract results.

2.1.2.3. Topic 12.30 : Remote Sensing

9 projects were funded at a total cost of 1,014,370 ECUs which amounts to 6.5% of the overall expense for the Primary Raw Materials R&D programme, and 13,5% of the funds allocated to exploration.

The following research areas were covered by these projects :

- Literature review : 1
- Landsat MSS data for mineral exploration in Greenland : 3
- Landsat MSS data for hidden cupola detection : 1
- Microwave techniques : 2
- Computer correlation of multi-data sets : 2

All of the projects were subjected to a closer study of the final reports. These were : 002 D, 014 F, 079 DK, 112 DK, 136 F, 152 NL, 154 NL, 116 UK, 159 EIR. In addition, an overview of significant results was given by the EC staff.

- Literature review

002 D An extensive review of the quite substantial literature describing the phenology of the vegetation cover and its relation to different

lithologic units and mineral parageneses in the bedrock was conducted. This evaluation presents all the available data on geobotany as related to remote sensing. Unfortunately, up to now this study has not been published due to the considerable volume of the report.

- Landsat MSS data for mineral exploration in Greenland

This project was conducted as a joint Franco-Danish research project by the contracts : 014 F, 079 DK and 112 DK.

In Central East Greenland, Landsat imagery and airborne sensors were both used for delineating possible areas for mineralisation. The results are in good agreement taking into account the difference of resolution (80 m for Landsat and less than 5 to 15 m for the airborne Daedalus). Mineralised test sites (for example, a molybdenum porphyry) have been selected for the application of the developed software. Around 100 major rust zones, some of them related to mineralisation, have been delineated in an area covering around 80.000 km2.

Using Landsat imagery, a structural analysis of Central East Greenland has been carried out and lineaments and circular features have been mapped. A clear relationship was found between several sulphide mineralisations and a major lineament in the Northern part of the area. This lineament is a new target for further ground investigations.

- Landsat MSS data for the detection of hidden cupolas

136 F One project dealt with the detection of mostly hidden domal structures in the Massif Armoricain and the Massif Central. One circular feature out of 300

newly detected ones was selected for a more detailed field study. It could be shown that a geological dome was actually there that had not been detected until now by field methods.

- Microwave techniques

152 F and 154 NL : Two projects were concerned with the processing and analysing of microwave data from the SAR-580 experiment obtained over the "Les Vans" test site in France, and of SAR-580 data in conjunction with thermal IR data and Landsat imagery obtained over part of the pyritic belt in Southern Spain. Due to difficulties also experienced elsewhere with late delivery and inconsistent quality of the SAR data, both projects have experienced delays. Meanwhile, encouraging results have been obtained from the Spanish test site, where indications for a possible extension of a pyrite deposit have been found.

- Computer correlation of multi-data sets

116 UK and 159 EIR : In two projects, the capability and the potential of image analysing systems for the presentation of different data sets (Satellite and aerial imagery, structural, geological, mineralogical, geophysical and geochemical data) was investigated. One project was conducted in Central Ireland, an important Pb-Zn province in which stratiform and vein deposits occur in Carboniferous rocks, and the other in the North and South Pennine ore fields of Central and Northern England. Multivariate analysis and interactive computer analysis of such large and diverse sets of exploration data proved to be very helpful and provided new insights for the exploration geologists. Mining companies have become interested in the areas studied as a direct effect of the EC sponsored research.

Two contractors (116 UK and 112 DK) were invited for interviews.

- Contract 116 UK : "Computer correlation of geological, geochemical and geophysical prospection data with enhanced satellite imagery"
  . Contractor : Hunting Geology and Geophysics Ltd.
  . Duration : 3 3/4 years
  . EC contribution : £ 120,000 (177,100 ECUs).

  The project was aimed at developing computer correlation techniques that could effectively aid the geologist faced with large and diverse sets of exploration data. Two areas in the North and South Pennine ore fields were selected which contain widespread lead/zinc mineralisation the distribution of which is well known. In addition, drainage sediment geochemical data were used as well as digital terrain models for the study areas. All in all, 13 data sets relevant to mineral exploration were combined in digital form. The study is an exercise in the application of a large and detailed digital data bank for different combinations of data in an easily interpretable form.

  The work performed demonstrates the value of computer graphics - and, to a lesser extent, of image processing - for providing the exploration geologist with multiple data sets that are easily understandable, and that enhance spatial relationships between geology, structure, geophysical, geochemical and mineralogical data that are otherwise difficult or impossible to perceive. Of the two different approaches used - interactive combination of data sets and mutivariate statistical analysis - the former produced results that could be interpreted and used with less difficulty.

- Contract 112 DK : "Application of remote sensing to prospecting for mineral deposits"
  . Contractor : The Technical University of Denmark, Lyngby
  . Duration : Project extended from first programme
  . EC contribution : 1,095,800 DKr (156,600 ECUs).

The objectives of the research were twofold. The first was to investigate the applicability of statistical methods in the analysis of satellite images in order to delineate potential mineralised areas. The second aim was to apply such methods to the mapping of spectral anomalies in Central East Greenland. The methods used consisted of an extensive test run of different spectral classification algorithms in an area where oxidised "rust" zones outcrop in areas of rather pronounced relief, but with no chemical weathering or vegetation cover of the bedrock.

Most of the known classification procedures (colour composites, ratios, principal components, canonical analysis) were run on imagery of the test site. The mineral targets showed up very well in most of the classifications used. Colour composites based on band-ratioing gave nearly identical results as compared to the other, more time-consuming algorithms. Of course, the physiographic properties of the arctic landscape of Greenland are an exception within the European Community, so additional studies of vegetation-covered mineral targets would appear desirable. For Greenland, the results are impressive, and they definitely point to an economic exploration technique under these conditions.

Synopsis of responses from questionnaires

8 questionaires were sent out to this group.

This synopsis is based on comments from 7 questionnaires returned, corresponding to 87% of the contractors.

Most of the contractors felt that the programme enabled them to expand already existing research capacities ; two researchers reported the creation of new research facilities. All contractors were able to acquire additional funding as a consequence of this programme.

A maximum of 4, and typically only 2 researchers were employed in executing the contracts.

Multidisciplinary research was the main motivating factor among this group in applying for funds.

Most contractors reported difficulties in maintaining their work schedules, mainly as a result of two factors : one was the underestimation of the workload required for the execution of the projects, and the other was delays in conducting the necessary associated field work as a consequence of extraneous influences.

The side benefits of the programme were mainly related to the development of image processing techniques which, in part, have already been applied to image analysis in the medical field.

Most contractors were not satisfied with the initial phases of their contractual relationship with the EC. Some contractors had to resort to prefinancing to overcome administrative delays. Monitoring and follow-up were, in general, deemed satisfactory.

The group felt that dissemination of information should be improved. In particular, there was no organized exchange of reports.

The contractors considered their immediate contacts with the scientific and administrative staff of the EC quite satisfactory, but felt that in this comparatively young science the contractors should have additional recourse to a specialist panel in specific cases.

There was a common feeling among the contractors that the 50% funding level is far too low and too inflexible for that largely institutionally based research area especially when considering that capital establishment and operating costs are rather high as compared to other fields of activity.

Again, the lack of an official publication of the contract results was felt to be a serious shortcoming and it was suggested that the EC take initiatives in this area, and look also into the integration of the European based results in remote sensing with NASA through ESA.

2.1.2.4. Topic 12.40 : Drilling Techniques

Two projects were funded at a total cost of 127,400 ECUs which represent 0.8% of the overall expenses of the Primary Raw Materials R&D programme, and 1.7% of the funds allocated to exploration.

No further in-detail evaluation of this topic was conducted because of the limited importance of this subject area within the overall programme.

2.2. Ore Processing

This field was subdivided as shown below along with the relevant funding (see also Annex 4.7).

	ECUs
Topic 20 : Specific ore processing	1,841,733 (16 projects)
Topic 21 : In situ leaching	482,592 (4 projects)
Topic 22 : Alumina from non-bauxite sources	1,633,351 (6 projects)
Topic 23 : Complex Pb-Zn-ore	2,441,663 (14 projects)
Topic 24 : Chlorination	491,960 (1 project)
Total ore processing	6,891,299 ECUs

corresponding to 44.45% of the total budget

2.2.1. Topic 20 : Specific Ore Processing and Metal Recovery

16 projects were funded at a total cost of 1,841,733 ECUs which represents 11.9% of the overall expense for the Primary Raw Materials R&D programme, and 26.7% of the funds allocated to ore processing.

The following research areas were covered by these projects :

- Heavy media separation : 1
- Liquid membrane separation : 2
- General extraction techniques : 5
- Hydro-metallurgical separation : 1
- Mathematical modelling : 4
- Mineralogical studies : 3

The following contracts were selected for a closer study of the final reports : 003 D, 133 F, 057 UK, 058 UK, 093 I.

Three contractors were invited for interviews.

- Contract 003 D : "Gravimetric separation of iron ores in the 2.0 mm to 0.1 mm size range by means of heavy media cyclone"
  . Contractor : Studiengesellschaft für Eisenerzaufbereitung Liebenburg
  . Duration : 2 years
  . EC contribution : DM 700,000 (275,400 EUCs).

  The aim of this research project was to get a more efficient separation of certain iron ores in the size range smaller than 2.0 mm and the extension of an already known method to smaller grain sizes respectively.

  Through the study, Ep values of 0.04 and lower have been obtained for the +0.315 mm, Ep values of 0.08-0.09 for the class -0.315-+0,2 mm and of 0.13-0.15 for the class -0.2+0.1 mm. Also on -0.1 mm a certain separation has been obtained.

The circuit technology has been improved by thickening the non-magnetic product of the first magnetic separation before the second magnetic separation, so that ferrosilicon losses have been reduced to 600-800 g/t (by usual systems the losses were between C. 1000 and C. 2000 g/t).

The tests on different ores show very encouraging results and demonstrate that the heavy media dynamic separators can give grades and recoveries higher than alternative gravity systems.

This work will be demonstrated on an industrial scale at a plant currently under construction at Bad Grund mine of Preussag with a Tri-flo separator.

- Contract 093 I : "Geostatistical models for the simulation of production cycles and upgrading of non ferrous metal minerals"
  . Contractor : SAMIN S.p.A., Rome and Università di Trieste
  . Duration : 30 months
  . EC contribution : 93,361,000 Lire (86,500 ECUs).

  The project objective was to provide simulation of production processes to give management a broader scientific information base upon which to draw for the optimal management of reserves. The historical data was derived from drilling information from the Marx Pb/Zn mine in Sardinia. The project involved the modelling of the orebody followed by the simulation of stoping and other mine related unit operations.

  More work was done on the mining operations than originally anticipated. This additional work permitted a complete system to be developed and this has been taken over by the operational staff thereby more clearly demonstrating the benefits of the project.

  The project has proved to be of significant value and it is to be hoped that future work on both this and other locations will break through the barrier of site specific systems to a point

where a highly flexible "tailored" system could evolve. This would have enormous benefit not only in resource management but also in productivity.

- Contract 058 UK : "Development and application of a new liquid membrane separation process for selective recovery of copper, uranium and other materials from low grade ores and dilute solutions"
  . Contractor : University of Manchester and Institute of Science and Technology
  . Duration : 3 years
  . EC contribution : £ 115,710 (170,700 ECUs).

The aim of the project was to develop a system for extracting metals from solutions with very low concentrations of heavy metals, to be used particularly in the treatment of low grade ores and to refine the system in a pilot plant, collect engineering data and obtain performance profiles of the necessary organic chemicals used as strip phase.

It has been demonstrated that the liquid membrane (LM) separation process, realized using organic solvents, can extract heavy metals with high recovery from solutions having very low concentration. For example, it is possible to extract 99% of the copper from solutions containing 100 ppm copper in relatively short contact times. The emulsion characteristics and some problems regarding stability during time and breakdown after extraction have been carefully studied.

The extraction of heavy metals (copper, uranium as indicated in the report) as well as noble metals is a very important objective for the Community. This separation method, or similar systems, which make it possible to obtain high recoveries from low tenor solutions and then facilitate the treatment of low grade ores or residues may have a marked impact on the mining and metallurgical industry and on the problem of finding and saving resources in the field of noble and strategic metals in general.

Synopsis of responses from questionnaires

16 questionnaires were sent out to this group.

This synopsis is based on comments from 10 questionnaires returned, representing 63% of the contractors.

Most of the contractors felt that the programme enabled them to maintain and expand their already existing research capacities ; two also reported the creation of new research facilities. 8 of the contractors were able to acquire additional funding as a consequence of this programme ; 2 of them, however, reported a cut of 20% in their national funding.

A maximum of 14, and typically 2-4 researchers were employed in executing the contracts, in most cases on a part-time basis.

Expansion of scientific knowledge and technical know-how was the main motivating factor among this group in applying for funds ; several contractors also entered the projects for the reason of getting longer-term funding for research.

Most contractors reported no difficulties in maintaining their work schedules. All delays encountered were due to technical difficulties in the execution of the project on the part of the contractor. All contractors felt that the project was totally or, at least, to a high degree successful.

The side benefits of the programme were mainly related to the establishment of new contacts. More than 50% of the contractors saw the applicability of their research in other fields as well, like scrap recycling or in biotechnology.

Nearly all contractors were not satisfied with the initial phases of their contractual relationship with the EC. This applies to the time schedule as well as to the general procedure of letting of

the contracts. On the other hand, the follow-up and monitoring of the contracts was considered as satisfactory ; some contractors would have liked more frequent contacts.

The group felt that the dissemination of information was mostly allright.

The contractors considered their immediate contacts with the scientific and administrative staff of the EC as satisfactory to excellent, whereas the administrative side should be improved, especially in respect to timing.

The 50% level of funding was considered as allright by most of the contractors, if 50% being the minimum acceptable for conducting major projects. On the question of bi- or multinational contracts the opinions were divided, with some emphasising more the advantages of international cooperation, and others fearing the added problems in management and sharing of responsibilities.

The lack of official publication of the contract results was seen as a shortcoming, and the suggestion was made that a data bank on relevant data might be initiated and supported by EC.

2.2.2. Topic 21 : In-Situ Leaching

4 projects were funded at a total cost of 482,592 ECUs which represents 3.1% of the overall expense for the Primary Raw Materials R&D programme, and 7.0% of the funds allocated to ore processing.

The following contract was selected for a closer study :
054 UK : "In-situ leaching ; laboratory simulation and modelling studies"

- Contractor : Warren Spring Laboratory/BRGM
- Duration : 33 months
- EC contribution : £ 44,750 (66,000 ECUs).

None of the contractors was invited for an interview.

Review of the report 054 UK

The final report selected for study dealt with the establishment of mathematical modelling parameters based on laboratory and pilot scale leaching test work in an attempt to obtain a predictive algorithm.

The work was done on a sample of ore from the Avoca mine in Ireland and involved agitation and percolation leaching at the +/- 3 kg scale and percolation leaching on a 7 t scale using "as blasted" material for 320 days.

Three types of models were developed for zinc extraction :
1) Diffusion only control
2) A mixed kinetic model (sharp-edged reaction)
3) A mixed kinetic model (part diffusion).

It was concluded that the extraction of zinc was mainly diffusion controlled and all three models worked well for larger, fully wetted particles where, for smaller particles, model 3 provided the best fit.

The work has provided working models for the ready assessment of laboratory work on any deposit and gives a basis for other workers to progress more rapidly towards site specific predictions.

Synopsis of responses from questionnaires

Four questionnaires were sent out to this group.

This synopsis is based on comments from 2 questionnaires returned, representing 50% of the contracts.

One of the contractors reported the creation of new research capacities, the other the expansion of existing facilities. Additional funding could be obtained as a consequence of the programme.

2 to 3 researchers were employed in the execution of the projects, the motivation for which being advances in new technologies.

The work schedule was reported to have been hampered by delays in the setting up of the project and technical problems. Consequently, the project objectives were only met in part. One contract reports difficulties arising from delays in the funding of the project.

The follow-up and monitoring of the projects was seen as good to satisfactory, as well as the dissemination of information.

The contractors considered their immediate contacts with the scientific staff of the EC as positive, while they felt that the administrative side should be improved upon.

New scientific contacts were formed as a consequence of the programme, partly also across national borders.

The wish for publication of results was also expressed by this group.

2.2.3. Topic 22 : Alumina from Sources other than Bauxite

Six projects were funded at a total cost of 1,633,351 ECUs which represents 10.5% of the overall expense for the Primary Raw Materials R&D programme, and 23.7% of the funds allocated to ore processing.

The following three projects were selected for a closer study of the final reports (096 I, 059 UK, 062 UK) and one contractor was invited for an interview (096 I).

- Contract 096 I : "Direct production of Al/Si alloys from leucites"
  - . Contractor : ALUMETAL S.p.a., Milan
  - . Duration : 3 years
  - . EEC Contribution : 1,070,000,000 Lire (991,000 ECUs).

The aim of the contract was to study the feasiblity of a process to obtain directly from leucite an aluminium-silicon alloy, by carbothermic reduction in an electric arc furnace, and to complete the experimentation on carbothermic reduction, processing leucitic tuffs and high-silicon bauxites.

The primary objective was to produce a useable Al/Si alloy by the carbothermic reduction of leucitic rock and this was achieved in that a fairly pure Al/Si alloy was produced ; however, despite using various mixtures of leucite and bauxite effective recovery was only achieved if a high Si alloy was produced. This alloy was in the region of 1:1 Al : Si with about 4% Fe and this was tested on a pilot plant scale and the development of basic systems occupied much time.

The work done showed that a much greater effort than anticipated was required to refine the impure alloy.

The scientific and technical contribution of the project to the general objective of finding aluminium sources other than the traditional ones is an important one.

An important general objective of the Community is to find new sources of raw materials, hopefully internal, alternative sources. Leucite is one of the alternative sources for aluminium, of which big ore bodies exist in Italy. The programme makes an important contribution to that objective.

Synopsis of responses from questionnaires

Six questionnaires were sent out to this group.

This synopsis is based on comments from 2 questionnaires returned, corresponding to 33% of the contractors.

Both contractors reported the maintainance, and one the expansion of existing research capacities. Additional funding could be obtained as a consequence of the participation in the programme, if to a minor degree.

2 to 4 researchers were employed in the execution of the projects ; research and economic interests wer the main motivating forces for participating in the programme.

The work schedule could be kept without difficulty, and consequently the project objectives were reached. As additional benefits from the EC programme the highly instructive technical meetings are mentioned.

The time between the call for and the submission of proposals was regarded as too short, whereas the follow-up and monitoring of the progress was found to very satisfactory and of great help to the contractors.

New scientific contacts were established within the respective countries and across borders, and the contractors would have liked an even stronger initiative of the EC in this field.

The group felt that results of projects which are not published in the usual journals should be published by the EC in some form.

As a general comment, it was mentioned that the EC should provide greater political and financial support for research directed towards the utilisation of the EC indigenous mineral resources.

2.2.4. Topic 23 : Complex Lead-Zinc-Ores

14 projects were funded at a total cost of 2,441,663 ECUs which represents 15.8% of the overall expense for the Primary Raw Materials R&D programme, and 35.4% of the funds allocated to ore processing.

The following research areas were covered by these projects :

- Plant optimisation : 2
- Hydro-metallurgy : 5
- Flotation : 4
- General techniques : 3

Three contracts were selected for a closer study : 020 F, 035 D, 005 D. One contractor was invited for an interview (005 D).

- Contract 005 D : "Improvement of a processing method for the highly pyrite graded complex Pb+Zn ore deposit of the Meggen Mine, with respect to low-grade ores of less that 7% Zn content"
  . Contractor : Sachtleben Bergbau GmbH, Lennestadt
  . Duration : 34 months
  . EC contribution : DM 2,736,000 (1,076,300 ECUs).

  The aim of the project was to improve processing techniques for the high-pyritic Pb-Zn ore of Meggen, so that the economy of the exploitation could be maintained, even when a greater amount of low-grade ore must be mined.

  In the first part of the project, by means of separate grinding of the low-grade and the normal ore and an improved system of separate flotation of the ores, in spite of the decreasing Pb and Zn content in feed ore, the concentrate grades and the recoveries were maintained, together with the economy of the mine operation.

  In the second part of the project, pilot plant studies were made on the recycling of zinc cleaner tailings and zinc middlings in order to simplify zinc flotation and improve the metallurgical results. An interesting open circuit technique with a system of pyrite recovery at low cost, less water contamination and with energy saving, has been developed and is now being used successfully at Meggen mine.

The results are the consequence of a detailed scientific and technical work. Most of the tests are industrial test runs long enough to be significant in spite of the feed variations.

The problem of treating high-pyritic ores and optimizing the operating conditions in order to obtain good concentrate grades and high recoveries, in some conditions, is very difficult and of general interest for the Community. The study is a practical example in which a good programmed research may contribute to the solution of incoming problems (change of ore, lowering of grade, very fine dissemination of minerals, presence of pyrite).

Applying the results of this project, the possibility of discontinuing Meggen mine operation has been prevented.

Synopsis of responses from questionnaires

11 questionnaires were sent out to this group.

This synopsis is based on comments from 7 questionnaires returned, corresponding to 50% of the contractors.

All contractors felt that the programme allowed them to maintain and expand their already existing research capacities. Most of them were able to acquire additional funding as a consequence of their participation in this programme ; 2 of them, however, reported a reduction in their national funding.

A maximum of 16, typically about 2-8 researchers were employed in executing the projects, in most cases on a part-time basis.

The chance for improvement of existing technology and knowledge was the main motivating factor among this group in applying for funding ; one contractor sought to improve the self-sufficiency of the EC with titanium.

All contractors had no difficulties in maintaining their work schedule, despite some minor technical problems. All of them regarded their research objectives as at least partly, or in the majority of cases, as substantially met.

The contacts with other research groups, also during the technical meetings, were regarded as highly valuable side benefits by all contractors. The applicability of results to other field is confined within this group to closely related fields like mineralogy or metallurgy.

All contractors expressed dissatisfaction with the initial phase of their contractual relationship with EC. This dissatisfaction applies to the time schedule as well as to the general procedure of letting of the contracts. On the other hand, the monitoring and follow-up of the contracts was considered as good to excellent.

Notwithstanding the difficulties reported in connection with the letting of the contracts, this did only rarely lead to any delays in the execution of the work.

The contractors considered their immediate contacts with the EC scientific staff as very satisfactory, while the administrative side was felt to be slightly less efficient. The technical meetings were appreciated as very informative, and the wish for more such interaction was expressed.

Dissemination of information was considered as good by all contractors. The 50% level of funding was mostly considered as adequate.

Most contractors established new scientific contacts on a national and an international level, even if only few contacts were considered as intensive.

The publication policy of the Community was mostly found to be adequate ; again the idea of a Community supported data bank was brought forward.

2.2.5. Topic 24 : Chlorination and other Valorization Methods, using in particular Slags and Residues from Metallurgical Plants

One project (115 I) was funded at a total cost of 491,960 ECUs which represents 3.2% of the overall expense for the Primary Raw Materials R&D programme, and 7.1% of the funds allocated to ore processing.

The project was subjected to a detailed study of the final report, and the contractors were invited for an interview.

- Contract 115 I : "Recovery of metals (Pb, Zn, Cu and others) contained in slags by non-conventional hydrometallurgical processes, high temperature, chlorination and other"
  . Contractor : SAMIM S.p.A. Rome, PERTULOSA, S.p.A. Rome
  . Duration : 2 years
  . EC contribution : 560,000,000 Lire (492,000 ECUs).

  The contract aimed to study hydrometallurgical/pyrometallurgical processes for recovering metals, to be found in zinc electrolytic processing or blast furnace residues, differing from those at present used producing pollutant residues (jarosite, goethite, hematite). In fact, it is foreseen that these residues will no longer be allowed to be stocked.

  One of the contractors dealt more extensively with hydrometallurgical processes (Pertulosa), the other restricted his interest to pyrometallurgy.

  Pertulosa firstly studied the treatment of low acidity leaching residues coming from electrolytic zinc plants. Two processes have been studied :
  a) total dissolving and recovery of metals ;
  b) selective dissolving of some metals (excluding zinc ferrites).

Process a) appears to have no economic interest ; process b), tested on pilot scale, appears to be interesting for residues containing silver. Subsequently, the treatment of lead sulphates coming from high acidity leaching or pyrometallurgical residues has been studied. Two ways have been tested : i) electrolysis ; ii) cementation. Both processes gave interesting results with lead and silver recovery higher than 95%.

SAMIM studied a new pyrometallurgical system of treating residues, similar in concept to the Waelz process, but working in a rotating furnace (with vertical axis) at high temperature enabling the melting of the charge. The system has been called "Rotofuming Process" and has been patented. Like the Waelz process, it recovers efficiently the volatilized metals in the form of oxides or salts, and rejects a poor slag insoluble in water, thereby reducing environmental problems.

2.3. Mining Technology

This field of activities was broken down as shown below with the relevant funding :

	ECUs
Topic 31 : Deep deposits : 10 projects	909,805
Topic 32 : High grade deposits : 3 projects	206,909
Total Mining Technology :	1,116,714 ECUs

corresponding to 7.20% of the total budget

2.3.1. Topic 31 : Deep Deposits

Ten projects were funded at a total cost of 909,805 ECUs which corresponds to 5.9% of the overall expense for the Primary Raw Materials R&D programme, and 81.5% of the funds allocated to mining technology.

The following research areas were covered by these projects :

- General mining methods 3
- Geotechnical studies 4
- Water ingress studies 2
- Ventilation 1

Four contracts were selected for a closer study of the final reports (128 D, 022 F, 023 F, 141 I). One contractor representing 2 projects was invited for an interview, but could not attend. Therefore, the following remarks are based on report studies only.

a) General mining methods

Three projects are related to excavation technology and underground exploitation methods (128 D, 141 I, 022 F), two of them in particular being devoted to backfilling and one to continuous mining.

In the contract 128 D, a new backfilling machine has been developed and successfully tested on an industrial scale using cemented fill. The system is useful in general for difficult mines with variable dip conditions and having subsidence problems.

Contract 141 I gives an example of using treatment residues for filling, contributing both to the stability of the mine and to solving the problem of disposal of such residues.

Contract 022 F is related to modelling of cutting heads of continuous miners, with scale up from a standard testing head to the industrial one with a view to predicting the performance of excavating equiment from small scale tests.

b) Geotechnical studies

Four contracts were related to rock mechanics and underground support (021 F, 023 F, 099 I, 029 NL).

One of them particularly refers to geotechnical exploration methods, taking into account the degree of natural cracking of the rocks. The other projects developed systems for solving stability problems in deep mines and contributed to the design of supports of underground drives.

c) Water ingress studies

Two projects are related to ground water problems (114 I, 065 UK), one of them concerning the Monteponi mine, in which 10 million tons of Pb/Zn ores could be exploited when the water problems would be solved. The other project is a more general study for modelling and estimating the water ingress of underground mines.

d) Ventilation

Contract (098 I) deals with the high temperature problems in the mine of Campiano (Tuscany).

Review of final report

- Contract 022 F : "Study of the action of picks and discs in mining machines by small scale models"
  . Contractor : Armines, Paris
  . Duration : 3 1/2 years
  . EC contribution : 281,240 FF (48,800 ECUs).

The principal aim of the project was to develop suitable models of the performance of the cutting heads of continuous miners, enabling the scale up from results obtained using small laboratory cutting heads to the results of industrial machines.

The research involved the construction and set-up of a small scale cutting machine (scale 1/6 of the industrial one) and the comparative analysis of the results obtained for different types

of rocks, with the corresponding results obtained using the cutting head Cherchar (of industrial scale) and industrial machines in mining operation.

The model of Lebrun for the action of the picks on rocks has been validated at different scales. A mathematical model, based on the dimensional analysis, has been developed and tested, and makes possible the correlation of the most important parameters of the rocks, the cutting machines and their performance at different scales.

In conclusion, the study demonstrates that a quantitative prediction of the excavation results of a continuous miner on an industrial scale is possible after performing tests using laboratory small scale cutting heads. Consequently, it may be possible in the future to avoid performing tests on an industrial scale, which at present is a very expensive procedure.

Synopsis of responses to questionnaires

Ten questionnaires were sent out to this group.

This synopsis is based on comments from one questionnaire returned, corresponding to 10% of the contractors. This contractor used the EC funding to create new research capacity, and could also attract additional funds as a consequence of the EC funding.

Despite some dificulties, the work schedule could be kept, and the research objectives were fully reached.

The general effectiveness of the management and the coordination were considered as good, and also the follow-up and monitoring was without problems.

The level of funding, while found sufficient, should be more flexible for projects involving higher risks.

The Community's role is seen by this contractor to encourage research of general interest.

2.3.2. Topic 32 : High-Grade Low-Tonnage Deposits

Three projects were funded at a total cost of 206,909 ECUs which represents 1.3% of the overall expense for the Primary Raw Materials R&D programme, and 18.5% of the funds allocated to mining technology.

No questionnaires were received from that group, and no contractors were invited for interviews.

General overview of the projects

Contract 127 D developed the design of small capacity transportable plants (from 5 to 20 tons/h) using some standard ore processing flowsheets. These plants may be used for small deposits or for pilot purposes.

Contract 024 F was to make an inventory within the Community of deposits having high-grade low-tonnage.

Contract 100 I was related to optimization of exploitation methods, optimal opening and excavation methods, development of models and planning.

Review of final reports

- Contract 127 D : "Transportable plants for the beneficiation of ores from small deposits with high-grade ore"
  - Contractor : KHD Engineering GmbH, Köln
  - Duration : 1 year
  - EC contribution : 267,457 DM (105,200 ECUs).

The aim of this contract was to design small capacity transportable plants suitable for use for high-grade low-tonnage deposits.

Engineering drawings were prepared for some standard ore processing flowsheets and for plant capacities of 5, 10 and 20 tons/h. The plants are composed of modular sections that can be assembled in different ways depending on the beneficiation problem. Comminution and classification, concentration by heavy medium, jigs, shaking tables, flotation and dewatering are included in different sections. No innovative solutions are proposed in comparison with the existing mobile mills already on the market but a larger choice of processes and capacities is given. These transportable plants may be useful, for easy treatment problems or pilot testing and probably for sale in foreign countries.

CHAPTER 3

3. CONCLUSIONS AND RECOMMENDATIONS

3.1. General Programme

The panel considered that the main objectives of the programme as they were originally conceived have been successfully addressed through the supported projects.

These objectives were :

- increase in self-supply potential in raw materials for the Community as a whole ;
- reduction of trade payment deficits ;
- development and export of new technologies for the exploration and exploitation of minerals.

It is, however, pertinent to observe that the relative impact of the programme on the objectives was so far, somewhat limited. Considering the low overall level of funding, this is not surprising. The work done by the various contractors was considered to be of a very high technical standard, for which the EC management should take considerable credit.

The selection of topics adhered to the priorities that existed in the late 1970's and, while some of the topic matters are as relevant today as they were then, there has been a fundamental change in the relative importance of many aspects of the work covered. It is considered that the shift in priorities is so fundamental that a restatement of Community policy on a periodic basis is desirable.

The panel considered that given the relatively low overall level of funding allocated to the programme by the Council and the spread of subject, this matter resulted, almost inevitably, in a large number of small projects. This not only attenuated the possible impact in any

given area but also gave rise to considerable administrative difficulties in that it was not quite compatible with the management resources of the Commission.

3.2. Exploration

3.2.1. General Comments

Nearly 50% of the total programme budget was allocated to exploration R&D. Currently the Community imports approximately 90% of its metallic raw materials and the aim of the Commission in this programme has been to increase the Community's self-sufficiency. Thus, an approximate 50% R&D budget funding towards exploration seems reasonable.

87 projects received 7,5 million ECUs over three years ; the funding per project per annum was on average 30,000 ECUs. For comparative purposes, it should be noted that one European mining company spends up to 8 million ECUs on the exploration of a single prospect per year.

Thus the absolute level of Commission funding can be seen to be insufficient to generate much economic impact.

However, the distribution of funding between the several subtopics seems to be generally reasonable.

Because of the localised nature of tenders submitted for contracts, distribution of funding has been on an unsystematic basis geographically within the Community. Thus the Commission should play a more positive role via, for example, a panel of experts from each country, in establishing priority areas for expenditure. This should be done prior to the call for tenders.

3.2.2. Comments on Topic 11 : Concealed and Deep-Seated Deposits in Europe

The projects under evaluation were on four groups of commodities :

a) Tungsten :

i) Two particular zones in the South of France are dealt with, one being the Pyrenees, project 080F, where the mine of Salau produces two-thirds of the tungsten used in France, and the other the Maures, where the mine of La Favière is under commercial exploitation. In both cases, the ore consists of a scheelite bearing skarn, a type of mineralisation which is widespread in Europe (France, Italy, Greece, Portugal), and often little known. In Greece (project 142 NL) a similar type of mineralisation is found on the island of Seriphos. A new W province with relatively high grade mineralisation (2% W) has been delineated in Central East Greenland but further RD must be concentrated on buried mineralisations.

ii) An area of Cornwall, in the United Kingdom, is also dealt with (project 038 UK and 041 UK), where a revival of interest in quartz-wolframite lodes has been noted.

b) Chromite :

The areas investigated were the Shetland Islands and three well-known areas of chromite-rich ophiolites. The idea at the basis of the study was to define criteria for prospecting which would be applicable elsewhere. This has been achieved successfully for another commodity, since the Shetland chromite has now been found to contain unusually high amounts of platinum group elements.

c) Lead-zinc-barium :

The Cevennes on the one hand (project 008 F), and the Eastern Alps on the other (project 092 I), are two zones where important deposits are under exploitation and where there still exists significant economic potential. A more upstream project on exhalites which might accompany volcanogenic mineralisation was undertaken in the Rheinische Schiefergebirge (project 105 D).

d) Copper :

The areas investigated were the Ordovician basement of Ireland, where the Avoca deposits are found (contract 126 and 067 EIR) and the Parys-mountain copper deposit on the island of Anglesy (040 UK).

In general, the topics selected correspond effectively to commodities which are of major interest to the EC and the areas selected for these studies can be said to be the most obvious ones.

Technical quality of the work

The best criteria to ascertain the scientific value of the research is that the results have been published in scientific journals. It must, however, be noted that some scientists have difficulty in publishing or publish very late, and out of 31 projects for topic n° 11, only about 18 have given rise to papers. More generally, one can say that 90% of the work undertaken was of good scientific quality.

Innovative approach

The methods used are often new and this is really one of the features of projects supported by the EC. For instance : stable isotope studies in projects 080 F, 126 EIR, etc. ; geochemical study of fluid inclusions in projects 038 UK, 041 UK and 111 B ; the study of trace elements in sulphides (project 111 B) ; in silicates (project 080 F) ; in chromites (project 043 UK). However, some contracts have used only conventional techniques and the element of innovation must rather be seen in the starting hypothesis of the work. Unfortunately, it can also happen that there is nothing new in a project, despite a promising title. However, this last instance is rare.

Was it worthwhile ?

Out of the 12 contracts which were studied in detail, 8 have given applicable results in mineral prospecting, and indeed, some of these results have already been applied since the end of the contract. The four other projects have yielded less practical results, mainly because they were too theoretical. However, in every instance the research performed is of good quality. It is, therefore, possible to say, on the basis of this sampling of contracts, that the objectives of the programme have, on the whole, been met.

To go into further detail, one could classify projects of topic 11 into two categories from the point of view of the efficiency of EC support :

a) Some projects were so vast that it is difficult to evaluate the efficiency of support. They are really part of a much longer-term investigation, of which the EC is just underlining the importance. This is the case, for instance, with projects 007 F and 160 I.

b) Other projects were much more specific, either in their geographical scope (this is the case with 5 out of the 8 projects examined above) or from the thematic point of view, which is the case with the three other projects : 080 F, 123 DK, 038 UK. In these cases, efficiency is easier to assess. It is in the order of 65%, that is to say, 65% of those projects with a specific aim have led to a valid economic result. Out of the other 35%, some apparent failures must really be ascribed to the contractor :

   - either the contractor wants to withhold the news of a discovery of ore which may have taken place while the project was being carried out ;
   - or the contracting company's own research budget is not enough to enable it to consolidate all the consequences of the research initiated with EC support.

3.2.3. Comments on topic 12.10 : Geochemical Methods

Methods of detailed geochemical prospecting received most attention followed closely by regional geochemical prospecting studies. In addition, projects were carried out on soil gases, hydrogeochemistry, dispersion halo studies and new analytical methods.

The technical quality of the work varied but overall standards were good. Attempts were made to introduce innovative techniques particularly in the fields of soil gas studies, hydrogeochemistry, dispersion halo studies and new analytical methods. The introduction of these innovative techniques is welcome and overall produced concrete results, except in the area of soil gas studies where the results, although encouraging, were still a little problematical. The hydrogeochemical work also did not produce concrete results in all cases. Nevertheless, as stated above, it has been worthwhile to encourage and fund these innovative techniques.

The remainder of the projects, which made up a little over 50% of the projects funded, involved both detailed and regional geochemical studies. Although purely classic methods were used the assistance of the Commission funding (though the latter was low as noted in 3.2.1. above) stimulated certain exploration projects. In the light of the comments already made in 3.2.1. above, this stimulation of exploration has been worthwhile.

The results of the detailed and regional prospecting projects have overall been encouraging and in several cases have lead to drilling programmes. In a few instances the results were not convincing and further work needs to be carried out to prove target areas.

The contractors under this project heading in general maintained their schedules, both throughout the course of the individual contracts and with regard to completion dates.

3.2.4. Comments on Topic 12.20 : Geophysical Methods

The contracts evaluated fell under four groups of topics, namely :

Airborne techniques

Only two contracts dealt with airborne geophysical methods : one was an aeromagnetic survey over Brittany, the other an aeromagnetic survey over Central Ireland. In both cases valuable knowledge on the regional geology was obtained.

Ground techniques

Ten contracts were concerned with various groundborne geophysical methods which comprised both the application of known methods to specific mineral targets like chromite deposits, and the development of new equipment as well as data processing and interpretation methodology.

Bore-hole techniques

Eight contracts dealt with the development of new equipment for bore-hole geophysics. Several projects were very successful as far as practical application and commercialisation of the results of these contracts is concerned.

Laboratory methods

One contract dealt with the development of a new laboratory method for proximity indication.

Technical quality of work

Keeping in mind that geophysical methods are generally rather expensive, the technical quality of the work performed was astonishingly high considering that the average funding for each of the 21 projects was only in the order of 22,000 ECUs per year. On the other hand, practically all the organizations supported by

contracts were well established research units with the necessary know-how that used the EC contracts to realize research ideas they could not have funded otherwise.

Notwithstanding the fact that many contractors had initial difficulties related to capital funding and development of new equipment, most of contracts were finished on time and produced the wanted results. Most of the results are published.

Innovative approach

While some of the projects were regional surveys that were conducted by classical methods (e.g. 073 EIR), quite a lot of contractors used the EC support for the development of new methods of data interpretation (like 137 F or 124 D) or the development of new equipment and methods (e.g. 082 F), especially for bore-hole measurements (146 UK, 010 F, 011 F).

Clearly, a lot of innovative approach research and development has been conducted, and part of these efforts has already found its way into commercial applications.

Was it worthwhile ?

The results of the geophysical work conducted were beneficial in two ways :

Firstly, the regional knowledge on the geological setting of several parts of the Community which have a high mineral potential but can be considered as under-explored, has been increased considerably.

Secondly, several new developments in the fields of methodology and equipment have resulted from the programme which increase the know-how and mineral exploration capability of European companies and government institutions.

So, especially in view of the mentioned relatively low level of funding in this field, the results were definitely worth the effort, and the funds can be considered as well spent.

3.2.5. Comments on Topic 12.30 : Remote Sensing

Remote Sensing is a relatively new tool in mineral exploration. The R&D programmes since 1978 have had several positive impacts in this field :

- the promotion of a wider use of remote sensing techniques, including the simulation of the imagery of the new generation of satellites (especially SPOT) in the second phase of the on-going programme ;

- the promotion of multinational collaboration such as the joint Danish-French campaign in Greenland ;

- the formation of multidisciplinary teams (geologists, computer scientists, statisticians, etc.) which has led to an improvement of remote sensing data processing, image enhancement and correlation of remote sensing data with already available geological, geochemical and geophysical data ;

- the inter-exchange of ideas by the creation of a remote sensing contact group ;

- the training of some geologists in data processing and interpretation of remote sensing imagery.

In fact, before the start of the R&D programmes in 1978, there was a definite lack of remote sensing specialists in several countries and the Commission is continuing its efforts to fill this gap.

Technical quality of the work

In all projects, the professional standard of the work done was good to excellent. It has to be noted that also in a comparatively new and expensive high-tech field such as remote sensing, the European research organizations are of a high standard.

In a new field such as remote sensing that is still developing very rapidly worldwide, it is a little difficult to define exactly what is innovative. The above projects were innovative in the sense that all of the problems attacked need more sound basic research, and at least on a European level the build-up of know-how in this field is desparately needed. There is also a need for a careful adaptation of existing remote sensing techniques to the specific conditions and requirements of European geological climatic and economic environment.

An answer to the question : "Was it worthwhile ?" can be given from two points of view. Considering the additional information that has been obtained on mineral occurences within the Community, most projects made valuable contributions : the most impressive example is, of course, the joint programme conducted in Greenland, where the climatic and logistic conditions make the use of remote sensing really imperative ; but also by other projects quite a lot of new information was presented, like on the Pennine ore fields or Spain.

Even more important at the present stage is the enhancement of knowledge in a new technology - remote sensing and image processing - within the Community, and the push this programme has given to international cooperation within the EC.

So, from both viewpoints, the sponsoring of remote sensing as applied to mineral exploration was definitely worthwhile, and merits further support in future R&D programmes.

3.3. Ore Processing

3.3.1. General Comments

Approximately 45% of the programme budget was allocated to this area amounting to 6,891,299 ECUs covering 40 projects. This is equivalent to a rate of expenditure of approximately 57,000 ECUs per project per year by the Community.

It is quite clear that this level of project expenditure is very low and only compatible with either
a) the briefest of initial exploratory work in any new process or
b) minor development work in already established processes.

The general level of project expenditure to do more than this would be required to be very much greater. That being said, the relative distribution of funds and the main subdivisions of subjects are considered to have been well thought out, and with the exception of perhaps one section which has been subject to a large economic shift in supply and demand, these subdivisions would be quite sensible for a new programme of work in this field. The general thrust of encouraging the development of new and/or improved processes to obtain better value from known and likely Community resources is totally endorsed. It is difficult to see how this could be improved from the point of view of subject matter and the general avenues of investigation. There are a number of projects which are similar - as to be almost duplicated.

Whilst this would appear to have been wasteful it must be remembered that this was a first attempt to define a Community initiative in this field and also the synergistic effects of these projects must be recognised. As such, the various contractors who applied for funding had to be regarded as more or less equivalent. It is of course understood that the Community, at that time, was much less able to insist upon, or otherwise direct a greater degree of collaborative work than is the case today or hopefully in the future.

Taking into account the large number of contractors (40) most of which were working simultaneously, the actual technical quality of the work done is of a high standard and some quite significant developments can be readily identified. This is a significant achievement in itself and speaks well of both contractors and the Commission staff who have had to deal with a very wide range of subjects and disciplines at the same time.

3.3.2. Comments on Topic 20 : Specific Ore Processing and Metal Recovery

This was the most general section of the ore processing area and attempted to cover the major unit processes in the recovery of metals from ores with the exception of pyrometallurgical techniques. This does, of course, reflect the views of the time when great effort was being expanded in looking for alternatives within the industry as a whole. In addition, the more general areas of mathematical modelling and mineralogical studies were also covered.

It is most noteworthy that the extremely innovative area (at the time) of liquid membrane separation was funded with considerable success.

The areas covered were all considered to be highly relevant to the industry at large, and the technical contents of the contracts were, without exception, of a very high standard.

In terms of work done to improve already established processes the work done on heavy media separation is especially worthy of note in that it provides a basis for major and fundamental changes in the application of this process to ore beneficiation.

With such a large spread of subject matter and contractors (16 in all) in this one topic, it is admirable that such little administrative difficulties were apparent and that schedules and objectives were largely achieved. The comment from contractors of initial delays would appear to have been real and largely a function of the not inconsiderable difficulties of assessing and letting such a large number of varied projects.

3.3.3. Comments on Topic 21 : In-Situ Leaching

This sector although small is considered relevant and the projects supported largely covered the various aspects of the field from physical leaching work through kinetic studies to mathematical modelling for prediction purposes. In terms of what was known in 1978, the work done can be considered relevant and the technical quality of the studies was high.

None of the projects could be described as innovative but all were extremely sensible and formed the basis for a workshop on mineral leaching held in Brussels in November 1983 and published in report EUR 9606.

3.3.4. Comments on Topic 22 : Alumina from Sources other than Bauxite

The apparent need to obtain feed for aluminium smelters from sources other than bauxite was very real at the time when these contracts were let. This would not be the case today, but could well reoccur.

The major consequence of the work was to more properly identify the options available, i.e. the possible sources of substitute alumina against the production of Al/Si alloys as a final product.

Within the original set parameters the work done was conducted in a fairly sensible manner although some of the individual project objectives were far too optimistic, probably reflecting a great desire at the time to achieve a breakthrough in a much publicised field.

The technical content was on the whole quite satisfactory albeit too innovative in some cases, particularly the direct production of useable Al/Si alloys, for which, however, new applications may be found in the future.

The schedules and objectives of the more adventurous projects were by and large not achieved but this is perhaps not surprising considering the pressure applied at the time to find almost any new source of aluminium feed stock.

3.3.5. Comments on Topic 23 : Complex Lead-Zinc-Ores

This topic is as relevant today as it was when the contracts were let.

The projects conducted contained both physical work including plant optimisation, and fundamental chemical considerations.

The problem in dealing with the valorisation of complex sulphide ores in general is very much governed by their variability and over the years the emphasis of work has moved very much towards more site specific studies benefiting from earlier work as exampled here when the main avenue of investigation was directed to finding a process or at least a framework of processes to treat these mixed complex ores.

In terms of the set parameters the work done was of a high technical standard and covered the correct areas of investigation with the exception of new and/or improved pyrometallurgical techniques but, as mentioned earlier, this was very much the vogue at the time.

None of the projects could be considered innovative but were all sensible from the point of view of adding valuable information to the subject which helped to better define the controlling sensitivities of the subject and improve the direction of further work which is, to a certain extent, reflected in the second programme.

3.3.6. Comments on Topic 24 : Chlorination and other Valorisation Methods using in particular Slags and Residues from Metallurgical Plants

This is an area where the amount of effort expended seems disproportionately low in terms of the importance to the Community as it has such fundamental influences in transforming what are currently

environmental problems into resources for the future. The very obvious success of the one project funded in this field gives reason to believe that this should be followed up more vigorously in future programmes (funding for this topic was also similar in the second programme).

In terms of actual project parameters the work done was of an exceptional standard and innovative.

Extremely promising results were obtained and highlighted areas where further work could well prove up an economic process.

If anything, the driving force for this avenue of investigation will increase with time as the economics will change in a favourable way when taking into account the proposed legislation on residue dumping and also on land use as a whole.

3.4. Mining Technology

3.4.1. General Comments

Approximately 7% of the programme budget was allocated to this area amounting to 1,116,714 ECUs covering 13 projects. This is equivalent to a rate of expenditure of approximately 29,000 ECUs per project per year by the Community. This is among the lowest levels of project expenditure for a research area within the programme and it is certainly extremely inadequate if it is to have a sensible economic impact.

Moreover, the number of funded projects appears to be rather limited in comparison with other areas. This is probably due to the fact that research in this area requires to a greater extent an involvement of the mines and the mining operators. It is therefore difficult for some projects that have to be carried out on an industrial scale to reach a compromise between the needs of research and those of production.

In spite of the limited number of projects, the final or partial results of some of them may be considered very interesting and in conformity with the objectives of the programme. The work done is generally of high technical standard and in one case highly innovative.

It can be pointed out that the projects cover only partly the topics within mining technology for which there is scope for innovation and further development. However, this can be changed with the establishment of the new programme.

The research projects in the field of mining technology in general pursued two types of objectives :

1) the first consists in the optimization of each single mining operation (i.e. improvement of supporting techniques, of the exploitation methods, of the transport, etc.) ;

2) the second one consists in the optimization of the operations as a whole that may be obtained using systems analysis, mathematical modelling, numerical simulation and optimization methods.

The two objectives are not in opposition ; on the contrary, the optimization of a group of operations has to be made after that of each single operation performed at a good grade of efficiency.

The research projects hitherto carried out belong to the optimization of single operations and to the development of knowledge in view of such optimization. In the first programme 1978-1981 projects in the Research Area III of Mining Technology did not address the second objective, even if such projects exist in the Research Area II - Ore Processing (see projects 016 F and 093 I). However, it should be noted that in the present programme 1982-1985 the new topic 3.3 - Geostatistics and Modelling in Mineral Exploitation - can incorporate the above optimization techniques.

In any case, it seems useful to underline again that the field of modelling, simulation, and in general "mining computer methods", to which many efforts are focused nowadays has to be expanded in the future within the programme, so that the Community, in the Member States of which most of the basic theory has been developed (e.g. Geostatistics), could maintain an important position in the fields of application and know-how. It is therefore recommended that projects for developing computer systems for management and control of mining operations have to be facilitated and adequately supported in the future.

Such type of research - instead of interfering with the production processes - if appropriately tailored on the needs of the mining industry, would have enormous benefit in resource management and productivity through an involvement of the operational personnel in modern information, control, and decision-making methodologies.

3.4.2. Comments on Topic 31 : Deep Deposits

The majority of the contracts within the mining technology research area as well as the most relevant ones and of more general interest, are in this sector.

Particular reference has to be made to some projects having innovative content : for example, the project on modelling of the performance of the cutting heads of the continuous miners. This project may open important perspectives for the study of the use of the continuous miner in stratified deposits, requiring small scale instead of full scale tests for prediction. Other interesting projects are related to the backfilling and relative machinery, the rock mechanics, the design of supports and other problems of the deep mines. Also studies presenting the "state of the art" in some important subjects may be useful if appropriately disseminated.

3.4.3. Comments on Topic 32 : High-Grade Low-Tonnage Deposits

From a general point of view this sector seems to be of rather limited economic impact to the exception of some particular cases and local situations.

The few contracts funded dealt with inventory of European small deposits, integrated mobile plants and optimization of exploitation.

Considering the large spread of different situations for high-grade low-tonnage deposits, the difficulty becomes apparent in defining research projects having general interest.

3.5. Management

The scientific management of the contracts has been conducted in a highly commendable and professional fashion. This is even more the case when it is considered that a maximum of six permanent staff have carried out the scientific management of the contracts, including monitoring, initial evaluation and selection, monitoring progress, including site visits and assisting in final report compilation.

The Commission was assisted in its task by an Advisory Committee set up by the Council but the Panel felt that the technical input from this Committee and its subgroups should have been more specialised and more detailed, which would have helped considerably with the effective execution of the work in hand. It is, of course, necessary to involve expert panels in the decision-making process but they should have more clearcut terms of reference and be closely associated with the type of work being planned and/or progressed.

In addition, it seems that the whole system - scientific and administrative management, contractors management, financial budgeting and control - produces delays in the allocation of contracts and in the timely transfer of funding.

In considering the above it is the opinion of the Panel that this work load under the present system involving such a large number of vario-discipline subjects made effective control and judicious decision-making dificult. This placed a large burden on the small number of Commission scientific staff.

3.6. Funding Policy

It is the opinion of the Panel that the overall level of funding for this programme was far too low in consideration of the socio-economic benefits which are manifest from developing a greater degree of self-sufficiency in primary raw materials. The funds to be made available for future programmes should reflect the importance of this field as a whole to the EC's economic future.

In addition, it is felt that this situation was further exarcerbated by the fact that the funding was spread over a large number of individual projects which in itself caused further difficulties with respect to effective management control.

With regard to the relative level of individual project support, i.e. at present approximately 50%, the Panel felt that this was too restrictive. Therefore consideration should be given to a more flexible approach whereby certain types of projects conducted by certain types of contractors could be funded at highly different levels - i.e. up to total funding or down to only minor support.

Consideration should be given to the allocation of some of the funds being made available for capital investment, as it was felt that the present policy was detrimental in that it did not provide sufficient flexibility for researchers to use state of the art technology. While this did not have a major effect on the quality of results from this programme the flow-on effects of future programmes will be significant.

It was considered that there is a distinct need to take greater cognisance of the fact that most of the sponsored research projects involve a disproportionate level of expense in the form of establishment costs, and that a greater degree of flexibility is necessary in the timing and the relative amounts of progress payments.

It has come to the notice of the Panel that 5% of Community contribution funds are withheld from any given project until after receipt of the final report by the Commission. The Panel felt that this policy was inappropriate in that it did not provide sufficient incentive for the contractors to do a satisfactory job, and only involved the contractor in prefinancing.

3.7. Information Transfer

It was the opinion of the Panel that the dissemination of information as a whole did not reflect the effort involved or merit of the programme in an adequate manner.

A number of publications and symposia papers have been published which are in themselves creditable documents. These however were not published in a systematic or easily accessible manner.

It is considered that there is a real need for a more readily identifiable source of information on work done which can be accessed by industrial and academic establishments and the interested public at large. This could well be in the form of abstracts so as not to incur disproportionate expense. This would have two prime benefits :

- the work done by the Commission would be better known, understood and appreciated by interested parties, and
- would have the knock-on effect of inspiring contractors to apply for funding which otherwise would not.

Consideration should be given to setting up general data bases for state of the art technology and information.

The present practice of organising symposia on synergistic contracts is highly commended and should be continued. It should also be considered using such methods as the basis for larger meetings augmented by outside specialists and papers. The present knowledge gap is felt, at least partly, to be responsible for the lack of significant collaborative project applications and also for the relatively slow breakdown of parochial interests.

3.8. Recommendations for future EC programmes

1. It is the prime recommendation of the Panel that the EC should agree on a clearly defined coherent European research policy on raw materials so as to enable a strategic perspective to be taken with the emphasis on overview and long-term Community advantage. The Panel recognises the inherent difficulties of such a task but nevertheless considers such a move essential for the ultimate development of a competitive mineral industry in Europe.

   Such a research policy should consider :

   - a periodically updated comprehensive review of the strategic implications of the supply and demand of primary raw materials within the Community ;

   - a study of the implications of the high-amplitude variations in the supply/demand ratio structurally affecting the field of primary raw materials, and of the short-term and long-term related actions that should be taken by the EC ;

   - a study of the problem of conservation of know-how in the field of exploration and production of raw materials, providing the EC with the capability to use and to export advanced technologies ;

   - a study of the socio-economic effects upon the Community including environmental constraints of the need to be more self-sufficient in primary raw materials ;

   - a study to evaluate the Commission's position in terms of its role in this field as a whole, i.e. should it merely act as a catalyst in that it would be reliant on governments or organisations to provide the driving forces in the R&D field, and/or should the Commission be responsible i.e. develop the capability within itself to direct, define, and execute specific projects on a multi-lateral/international basis but with the consideration being the Community benefit rather than the aggregate of national considerations.

2. The Commission also needs to formulate a policy in determining the relative levels of support which should be applied to the general upgrading of expertise within the Community as opposed to the more easily justifiable areas of immediate economic importance. The long-term benefits of improving fundamental techniques could well be more beneficial than the support of some more empirical types of projects which appeared to warrant urgent funding at the time.

   To date, two programmes have been completed, both with similar formats and levels of funding. The format and subject matter of these being largely based upon mid- to late nineteenseventies priorities, need to be revised in the light of probable future developments.

3. It is felt that the Community should take a greater interest in overviewing the general situation such as providing a continuously updated information base to assist in the formulation of its own programmes and these of member countries. It should become more involved in generic longer-range programmes of common interest which can attract true multinational cooperation.

   It is felt that to become involved with short-term needs merely causes conflict with national interests which of necessity must look for some return for effort in the immediate future.

4. In terms of money expended it is felt that the Community should be providing a valid service in research of a more general nature in terms of both technology and material supply and demand rather than entirely involving itself in a large number of relatively small technical projects, which, almost by definition, results in duplication of the type of work done on a national level. Of course, there will, and indeed should be some overlap of interest, but in general terms the emphasis should be towards the longer-term, more fundamental consideration and the larger, more internationally identifiable projects involving both physical work and review dossiers. Consideration should be given to the relative levels of funding amongst the following areas :

- general overview and identification of future needs (technology and materials),
- long-term fundamental projects,
- small technical projects,
- international and collaborative symposia,
- publications.

5. The Commission should ensure that the funding of future programmes is commensurate with their objectives and their relative importance. It is the opinion of the Panel that the absolute level of funding needs to be substantially increased in order to meet the objectives outlined above.

4 - ANNEXES

Annex 4.1

Meetings of Steering Committees

1) In-situ leaching

5-6 July 1979	Dublin	26 march 1981	Orléans
30 June - 1 July 1980	Avoca	26-27 November 1981	Avoca

2) Alumina from non-bauxitic sources

3 December 1979	Brussels	6 May 1981	Bonn
9-10 June 1980	Porto Marghera	15 December 1981	Brussels
27 November 1980	Gerrards Cross	25-26 May 1982	Porto Vesme
15 December 1981	Brussels		

Miscellaneous "information groups" in Exploration

1) Phosphate

13 November 1979	Brussels	15 July 1980	Paris
13 March 1980	Brussels		

2) Mineralisation associated with basic/ultrabasic rocks

25 October 1979	Brussels	22 May 1980	Brussels
29 January 1980	Orléans	29 April 1981	London
14-15 April 1980	Hannover		

Contact group meetings in research area I, and seminar

1) Geology

10 may 1979	Brussels	19-20 January 1981	Liège
7-10 January 1980	Cagliari	13 January 1982	London

2) Geochemical methods

11 May 1979	Brussels	14 January 1982	London
8-9 April 1980	Hannover	19 January 1984	Brussels (seminar
22-23 April 1981	Utrecht	on geochemical prospecting)	

3) Geophysical methods

21 June 1979	Brussels	3 February 1981	Brussels
18-19 March 1980	Cardiff	4-5 February 1982	Orléans

4) Remote Sensing

29 October 1979	Brussels	3-4 December 1980	London-Borehamwood
25-26 March 1980	Toulouse	15 September 1981	Brussels

Contact groups in research areas II and III

1) Modelling in ore processing

7 July 1980	Stevenage	16 November 1981	Masua
12-13 January 1981	Masua		

2) Ore processing

30 November 1979	Brussels	25 June 1981	Brussels (Portuguese
6 June 1980	Meggen		pyrites)
24 November 1980	Brussels	3-4 June 1982	Orléans
29 June 1981	Manchester		

3) Mining technology

23 November 1979	Brussels	23 June 1981	Delft
23 June 1980	Fontainebleau	10 December 1981	Meggen
16-17 December 1980	Torino		

LIST OF PROJECTS

R&D PROGRAMME IN THE RAW MATERIALS SECTOR
(Indirect action)
1978-81

I. EXPLORATION R&D

Topic 11: CONCEALED DEPOSITS AND DEEP-SEATED DEPOSITS IN EUROPE: TARGET SELECTION BY IMPROVEMENT ON KNOWLEDGE IN 'ECONOMIC GEOLOGY'

Topic 11.10: Improvement of knowledge concerning the types of deposits, their environment of deposition and their genesis

007	D	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Pouit	Volcanogenic Cu-Pb-Zn (Ag, Au) mineralisations of the Paleozoic
008	F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Bornuat	Methodology of the search for concealed and deep-seated deposits in sedimentary covers
009	F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES Orléans; Caia	Geological predictive criteria for prospecting concealed and deep-seated deposits in the flat-lying epihercynian cover of the French crystalline massifs
080	F	ARMINES, Paris; Fonteilles	A comparative study of tungsten-bearing skarns in the Pyrenees: structural and geochemical controls of mineralization, dynamics of metasomatism
122	F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Johan	Determination of the factors controlling chromite mineralization, with special emphasis on aids to mineral exploration
090	I	SAMIN S. p. A., Roma; Musso	Improvement of the knowledge of geodynamic and paleogeographic guides in the search for volcanogenic deposits of mixed sulphides. Determination of parameters for an optimal development of exploration programmes
091	I	ENTE MINERARIO SARDO, Cagliari; Tocco UNIVERSITA DEGLI STUDI, Cagliari; Marcello SAMIN S. p. A., Roma; Leonardelli	Stratiform deposits of lead-zinc and other base metals in sedimentary environments, particularly in cambrian carbonate shelves
157	I	ENTE MINERARIO SICILIANO, Palermo; Bommarito	Genetic models and future potential of the phosphorites of S. E. Sicily. Comparison with the phosphorites from Puglia
092	I	SAMIM S. p. A., Roma; Perna	Stratiform deposits of lead-zinc in permo-triassic sedimentary covers.
160	I	PERTULOSA, Roma; Brusca	Investigations of common metallogenic features and of correlations with basement geology, aimed at defining new exploration criteria
142	NL	RIJKSUNIVERSITEIT UTRECHT; Utrecht; Schulling	Quantification of skarn and ore formation on the island of Seriphos, Greece
031	B	SERVICE GEOLOGIQUE DE BELGIQUE, Bruxelles; Dejonghe	Metallotects of the Frasnian in the Vesdre massif (NE Belgium): their possible use as guides in prospecting for stratiform Pb-Zn-Ba deposits in carbonate rocks
143	B	UNIVERSITE CATHOLIQUE DE LOUVAIN, Louvain-la-Neuve; Verkaeren	Petrology and structure of the la Favière (Var, France) scheelite deposit. Comparison with other tungsten deposits in Southern France
039	UK	NATURAL ENVIRONMENT RESEARCH COUNCIL, London; Notholt	Investigation of the phosphate potential of the Loch Borralan igneous complex, northern Scotland, United Kingdom
040	UK	UNIVERSITY COLLEGE, Cardiff; Annels	A study of the Parys Mounbtain copper-lead-zinc-silver ore bodies and their structural environment
042	UK	ROBERTSON RESEARCH INT. LTD, Llandudno; Gaskell	Investigation of the thermal metamorphism caused by granitic intrusions, using the variation in reflectivity of vitrinite particles in the country rock, in south-west England
043	UK	THE OPEN UNIVERSITY, Milton Keynes; Gass	The chromite of the shetland ophiolite; an appraisal in the light of new theory and techniques
121	UK	THE OPEN UNIVERSITY, Milton Keynes; Gass	Determination of the factors controlling chromite mineralization, with special emphasis on aids to mineral exploration
148	UK	ROBERTSON RESEARCH INT. LTD, Llandudno; Bichan	An evaluation of the base metal potential of sedimentary basins based on oil-well sampling
149	EIR	TRINITY COLLEGE, Dublin; Stillman	The identification of 'fertile' and 'barren' basement source areas for Palaeozoic base metal mineralization in the UK and Ireland as a guide to effective exploration
077	DK	NORDISK MINESELSKAB A/S, Copenhagen; Hallenstein	Study of scheelite mineralization in Central/East Greenland
123	DK	UNIVERSITY OF COPENHAGEN, Copenhagen; Ghisler	Determination of factors controlling chromite mineralization with special emphasis on aids to mineral exploration

Topic 11.20: Improvement of knowledge concerning ore and wall rock mineralogy, petrology and chemistry

105	D	TECHNISCHE UNIVERSITÄT BRAUNSCHWEIG; Krebs	Lower Devonian exhalites in the Rheinish Schiefergebirge as possible distal extensions of volcanogenic sulphides
106	D	RHEINISCH WESTFAELISCHE TECHNISCHE HOCHSCHULE, Aachen; Förster	Investigation of alteration patterns in hydrothermal mineral deposits
081	F	UNIVERSITE DE POITIERS; Gabilly	Definition of a new metallotect in a carbonate environment

030 B	UNIVERSITE CATHOLIQUE DE LOUVAIN, Louvain-la-Neuve; Martin	Search for new, geochemical, metallotects in carbonate environments
110 B	UNIVERSITE LIBRE DE BRUXELLES; Herbosch	Search for new, geochemical, metallotects in carbonate environments
111 B	UNIVERSITE DE LIEGE; Evrard, Bellière	Search for new, geochemical, metallotects in carbonate environments
038 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL, London; Shepherd	Fluid inclusion chemistry
041 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Rankin	Fluid inclusion studies on mineralised granites of the British Isles, and an assessment of their use in the exploration for mineral deposits associated with granitic rocks
144 UK	UNIVERSITY OF ASTON Birmingham; Vaughan	Diagenesis and mineralization in red beds: exploration guides for U - V - Cu ores
067 EIR	GEOLOGICAL SURVEY OF IRELAND, Dublin; McArdle	The evolution of Irish mineral deposits as indicated by isotope geology
126 EIR		

Topic 12: IMPROVEMENT AND DEVELOPMENT OF PROSPECTING METHODS AND TECHNIQUES

Topic 12.10: Geochemical methods

001 D	BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE (BGR), Hannover; Van den Boom	Development and application of a geochemical exploration method using volatile elements
107 D	RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE, Aachen; Friedrich	Prospection of stratabound sulphide mineralizations in the western part of the Rheinisch Schiefergebirge
109 D	UNIVERSITÄT MÜNCHEN; Klemm	Geochemical and geostatistical prospecting for antimony deposits in southern Tuscany, Italy
117 D	HAHN-MEITNER-INSTITUT FÜR KERNFORSCHUNG, Berlin; Möller	Geochemical proximity indicators for stratabound sulfide deposits of non-ferrous metals
013 F	CENTRE DE RECHERCHES PETROGRAPHIQUES ET GEOCHIMIQUES (C. R. P. G.), Nancy de la Roche, Stussi	A contribution to the development of regional geochemical mapping
083 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Wilhelm	Improvement of geochemical prospecting techniques by means of phase selection
084 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Leleu	Utilisation of hydrogeochemistry in prospecting for concealed deposits
085 F	BRGM, Orléans; Fritsche	A contribution of new analytical methods to indirect geochemical prospecting for concealed deposits
087 F	BRGM, Orléans; Zeegers	Regional geochemistry: interpretation and mapping
088 F	BRGM, Orléans; Degranges	Prospection for concealed deposits by the study of soil gases
135 F	BRGM, Orléans; Kosakevitch	The use of gossans in mineral exploration
113 I	UNIVERSITA DEGLI STUDI, Cagliari; Fanfani	Investigations on hydrogeochemical prospecting for non-ferrous metals
120 I	SAMIM S. p. A., Roma; Leonardelli	Geochemical and geostatistical prospection for antimony deposits in Southern Tuscany, Italy
025 NL	RIJKSUNIVERSITEIT UTRECHT; Oosterom	Geochemistry of tin, tungsten and related elements such as tantalum and niobium
032 B	UNIVERSITE CATHOLIQUE DE LOUVAIN, Louvain-la-Neuve; Martin	Improvement of geochemical prospecting techniques by means of phase selection
033 B	KATHOLIEKE UNIVERSITEIT LEUVEN; Viaene	Prospection for Pb-Zn mineralization in the Dinantian carbonate rocks of Belgium, based on primary geochemical dispersion patterns
034 B	UNIVERSITAIRE INSTELLING ANTWERPEN; Gijbels	Hydrochemical prospection methods for hidden ore deposits, with special emphasis on the ultra-trace element content of water
045 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL, London; Ostle	The behaviour of components of soil air as a guide to the detection of buried ore bodies
051 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Hale	Investigation of the role of arsenic, antimony, bismuth, selenium and tellurium as pathfinder elements for base metal deposits using a new high-sensitivity plasma emission technique
072 EIR	IRISH BASE METALS LTD, Dublin; Meldrum	The geochemistry of lower carboniferous sediments in Ireland, its relationship to base metal deposits and applicability to the search for concealed deposits
078 DK	DANMARKS TEKNISKE HOEJSKOLE, Lyngby; Knudsen	Research in geochemical mapping of a well exposed area in East Greenland
156 GR	INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION, Athens; Demitriades	The use of primary and secondary dispersion halos of mercury in the prospection for concealed mineral deposits

Topic 12.20: Geophysical Methods

124 D	UNIVERSITÄT HAMBURG; Makris	A geophysical multi-method approach to chromite exploration
010 F	BRGM, Orléans; Borsier	*In-situ* determination of light elements of economic interest by neutron activation
011 F	BRGM, Orléans; Borsier	*In-situ* analysis of heavy elements by X-ray fluorescence
012 F	COMPAGNIE GENERALE DE GEOPHYSIQUE, Massy; Naudy	Automatic processing and combined interpretation of multi-method geophysical data from bottom and airborne surveys
082 F	INSTITUT NATIONAL D'ASTRONOMIE ET DE GEOPHYSIQUE, Paris; Mosnier	Improvement of an electromagnetic prospecting apparatus with a monitored source
086 F	BRGM, Orléans; Hentinger	Improvement of well-logging techniques in mining research
101 F	INSTITUT NATIONAL DE PHYSIQUE NUCLEAIRE ET DE PHYSIQUE DE PARTICULES, Paris; Siffert	*In-situ* analysis of heavy elements by X-ray fluorescence
102 F	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE, Paris; Albert	*In-situ* determination of light elements of economic interest by neutron activation
103 F	INSTITUT NATIONAL DE PHYSIQUE NUCLEAIRE ET DE PHYSIQUE DES PARTICULES, Paris; Siffert	*In-situ* determination of light elements of economic interest by neutron activation
137 F	BRGM, Orléans; Hentinger	Evaluation of the results of the aeromagnetic survey over Brittany, 1979, with respect to search for minerals in a volcano-sedimentary environment
118 NL	TECHNISCHE RIJKSHOGESCHOOL Delft; de Voogd	High Resolution Mining Seismics
044 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL, London; Masson Smith	Development of borehole geophysical systems
046 UK	NERC, London; Masson Smith	Study of induced polarization decay curves
047 UK	NERC, London; Masson Smith	Use of remote computers in geophysical/geochemical survey work
049 UK	NERC, London; Masson Smith	Geophysical investigations by Transient Electromagnetic (TEM) method
069 UK	RIO TINTO FINANCE & EXPLORATION LTD, London; Sharp	Evaluation of high resolution seismic reflection in the determination of structure in Irish carbonate rocks
146 UK	CAMBORNE SCHOOL OF MINES, Redruth; Kantaris	Development of a VLF-borebole probing apparatus for the location of deep-seated ore bodies
147 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL, London; Basham	Thermoluminescence profiles in ore-related hydrothermal zones
153 UK	NERC, Swindon; Masson Smith	Use of field-based microcomputers
073 EIR	GEOLOGICAL SURVEY OF IRELAND, Dublin; Inamdar	Aeromagnetic study of the structural control of mineralization in Central Ireland between latitudes 52° — 54° N with the object of identifying economic targets
151 GR	INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION, Athens; Papamarinopoulos	A multi-geoscientific approach as a test of heliborne EM-results over a mixed sulfide ore deposit

Topic 12.30: Remote Sensing

002 D	ALBERT LUDWIG UNIVERSITÄT, Freiburg i. Br.; Hildebrandt	Evaluation of the literature concerning studies of phenology of the Earth's vegetation cover and its ecological condition by remote sensing
014 F	GROUPEMENT POUR LE DEVELOPPEMENT DE LA TELEDETECTION AEROPATIALE (G.D.T.A.), Toulouse; Favard	Airborne remote sensing in East Greenland: a study of the applicability of multispectral remote sensing techniques in mineral exploration
136 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Scanvic	Methodology for hidden cupola detection by remote sensing: structural and petrographic study of LANDSAT annular structures
152 F	GROUPEMENT POUR LE DEVELOPPEMENT DE LA TELEDETECTION AEROSPATIALE (G.D.T.A.), Toulouse; Favard	Study of the contribution of multi-dimensional VHF remote sensing (X band, L band, parallel and perpendicular) on geological interpretation
154 NL	INTERNATIONAL INSTITUTE FOR AERIAL SURVEY AND EARTH SCIENCES (ITC), Enschede; Koopmans	Application of multi-band synthetic aperture radar imagery and thermal infra-red in exploration in mineralized areas in the pyrite belt, Prov. Huelva, Spain (Project SARTHI)
116 UK	HUNTING GEOLOGY AND GEOPHYSICS LTD, Borehamwood; Martin-Kaye	Computer correlation of geological, geochemical and geophysical prospection data with enhanced satellite imagery
159 EIR	TRINITY COLLEGE, Dublin; Philips	Correlation of geological, geochemical and geophysical data with satellite imagery, west-central Ireland
079 DK	GROENLANDS GEOLOGISKE UNDERSEOGELSE, Copenhagen; Henriksen	Airborne remote sensing in East Greenland
112 DK	DANMARKS TEKNISKE HOEJSKOLE, Lyngby; Conradsen	Application of remote sensing to prospecting for mineral deposits

Topic 12.40: Drilling Techniques

104 F	FORACO, Neuilly-sur-Seine; Hourcade	Quick and continuous core sampling down to 150m depth. Total recovery of ores of various consistencies, particularly those of heterogenous and unstable formation and those situated beneath non-consolidated, sterile zones
053 UK	UNIVERSITY COLLEGE, Cardiff; Thompson	Development of tubular motors for drilling operations

II. ORE PROCESSING

Topic 20: SPECIFIC ORE PROCESSING AND METAL RECOVERY

003 D	STUDIENGESELLSCHAFT FÜR EISENERZAUFBEREITUNG GES. BÜRGERLICHEN RECHTS, Liebenburr; Burghardt	Gravimetric separation of iron ores in the 2.0 to 0.1 mm size range by means of heavy media cyclone
004 D	INSTITUT FÜR CHEMIE TECHNISCHE UNIVERSITÄT, Hannover, Schügerl	Ore dressing by the liquid-membrane technique
006 D	FRIEDRICH KRUPP GmbH, Duisburg; Haubold	Exploration study of the non-ferrous metal ore deposit, Gümüskoy, Kütahya, Turkey
108 D	SALZGITTER AG, SALZGITTER; Grössel	Vanadium winning by a leaching process
016 D	ARMINES, IMETAL, Paris; Matheron	Geostatistical models for the simulation of production cycles and upgrading of non-ferrous metal minerals
131 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Baudet	Treatment of Armoricain sandstones containing titanium, zirconium and rare earths; production of a bulk concentrate
133 F	BRGM, Orléans; Bloise	Mineral liberation; measurement and analysis
093 I	SAMIM S. p. A., Roma — UNIVERSITA DI TRIESTE, Guarascio	Geostatistical models for the simulation of production cycles and upgrading of non-ferrous metal minerals
094 I	CONSIGLIO NAZIONALE DELLE RICERCHE, Roma; Rinelli	Mathematical models for mineral flotation
138 I	CONSIGLIO NAZIONALE DELLE RICERCHE, Roma; Rinelli	Production of saeable rutile concentrates for the economic exploitation of deposits in ecologitic rocks
140 I	SAMIN S. p. A., Roma; Musso	Optimisation of the mineral production cycle by the construction of numerical models and computer simulation
026 NL	TECHNISCHE RIJKS HOGESCHOOL, Delft; Roorda	Optimisation of light-optical and electron-optical techniques for application to the processing of complex and low grade raw materials
055 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Jones	The development of automatic methods for characterizing the mineralogy of low-grade and complex ores
056 UK	WARREN SPRING LABORATORY, Stevenage; Cutting	Treatment of complex and low-grade ores — Prediction of response to multi-stage processing Part I Gravity pre-concentrations and flotations
057 UK	WARREN SPRING LABORATORY, Stevenage; Parsonage	The effects of process-generated slimes on froth flotation performance
058 UK	UNIVERSITY of MANCHESTER; Davies	Development and application of a new liquid membrane separation process for the selective recovery of copper, uranium and other materials from low grade ores and dilute solutions

Topic 21: *IN-SITU* LEACHING

015 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Olliver	Heap laching of Cu, Zn, U ores
130 F	BRGM, Orléans; Ollivier	*In-situ* leaching study (on complex sulphide ores)
054 UK	WARREN SPRING LABORATORY, Stevenage; Flett	*In-situ* leaching; laboratory simulation and modelling studies
075 EIR	INSTITUTE FOR INDUSTRIAL RESEARCH AND STANDARDS, Dublin; Burton	Programme on *in-situ* mining technology

Topic 22: ALUMINA FROM SOURCES OTHER THAN BAUXITE

089 I	SAMIM S. p. A., Roma; Leonardelli	Utilisation of leucite-bearing rocks as alternative sources of aluminium
096 I	ALUMETAL S. p. A., Milano; Landi	Direct production of Al/Si alloys from leucites
059 UK	WARREN SPRING LABORATORY, Stevenage; Flett	Development of a process for the production of anhydrous aluminium chloride from non-bauxitic sources
060 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Rogers	Recovery of alumina from colliery and power station wastes
062 UK	— ENGLISH CLAYS LOVERING POCHIN & Co Ltd, St. Austell, Cornwall; Jepson — BRITISH ALUMINIUM Co Ltd, London; Brown	The production of alumina from clay materials, particularly the micaceous residues resulting from china clay production
063 UK	UNIVERSITY OF BIRMINGHAM; Bailey	The recovery of alumina from colliery spoil by alkaline and acid leaching processes

Topic 23: COMPLEX LEAD-ZINC ORES

005 D	SACHTLEBEN BERGBAU GmbH, Lennestadt; Heide	Improvement of a processing method for the highly pyrite graded complex Pb + Zn ore deposit of the Meggen mine, with respect to low grade ores of less than 7% Zn content
017 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Barbery	Optimum treatment of complex sulphide ores: application to the Breton deposits of Bodennec and Porte-aux-Moines
018 F	L'AIR LIQUIDE, Paris; Roussel	Treatment of chloride solutions obtained from leaching of complex sulphide ores of copper, lead, zinc. Purification (elimination of iron) and recovery of the metals (precipitation by hydrogen under pressure)

019 F	MINEMET-RECHERCHE, Paris; Demarthe	Comparative study of copper upgrading methods based on leaching solutions for complex sulphide ores (chloride process)
020 F	MINEMET-RECHERCHE, Paris; Predali	Improvement of lead recovery and concentrate quality in the flotation of fine sulphide ores
129 F	MINEMET-RECHERCHE, Trappes; Georgeaux	Heap leaching of fine pyritic ores for the beneficiation of the nonferrous metals contained (Pb, Zn, Cu)
132 F	MINEMET-RECHERCHE, Trappes; Predali	Study of the interaction between particles of galena, pyrite and chalcopyrite during fine grinding with a view to improving flotation recoveries
134 F	BUREAU DE RECERCHES GEOLOGIQUES ET MINIERES, Orléans; Ollivier	Purification of antimonial and arsenical sulphide concentrates by chlorination
095 I	CONSIGLIO NAZIONALE DELLE RICERCHE, Roma; Rinelli	Alkaline leaching of oxidised Pb/Zn ores
097 I	CONSIGLIO NAZIONALE DELLE RICHERCHE, Roma; Rinelli	Benefication of semi-oxidised Pb/Zn ores characterised by complex structure
125 I	UNIVERSITA DI ROMA, Roma; Massacci	Benefication of semi-oxidised lead and zinc ores characterised by a complex structure
027 NL	AKZO NV, Arnhem; Kater, James	Cellulose derivates as selective flocculants for fines in flotation technology
035 B	UNIVERSITE DE LIEGE; Ek	Valorization of pyrite by flotation and hydrometallurgy
064 UK	UNIVERSITY OF BIRMINGHAM; Lawson	Leaching and separation of lead and zinc from complex ores

Topic 24: CHLORINATION AND OTHER VALORIZATION METHODS, USING IN PARTICULAR SLAGS AND RESIDUES FROM METALLURGICAL PLANTS

115 I	SAMIM S. p. A., Roma; Rinaldi, Guerriero PERTULOSA S. p. A., Roma; Sambarino	Recovery of metals (Pb, Zn, Cu and others) contained in slags by non-conventional hydrometallurgical processes, high temperature chlorination and others

III. MINING TECHNOLOGY

Topic 30: MINING TECHNOLOGY

Topic 31: DEEP DEPOSITS

128 D	SACHTLEBEN BERGBAU GmbH, Lennestadt; Harnischmacher	Optimisation of slinger-belt waste stowing to minimise subsidence damages
021 F	ARMINES, Paris; Fine	Geotechnical exploration of mineral deposits
022 F	ARMINES, Paris; Tincelin	Study of the action of picks and discs in mining machines by small scale models
023 F	ARMINES, Paris; Tincelin	Comparative study of different ways of support of underground drives
098 I	SAMIM S. p. A., Roma; Pantaleoni	Analytical and experimental study of problems related to high temperature in deep deposits, e. g. in Campione, Tuscany (Italy)
099 I	POLITECNICO DI TORINO; Stragiotti	Stability of deep mines
114 I	SAMIM S. p. A., Roma; Perna	Definition of the water circulation parameters in carbonatic mineral deposits
141 I	MINERARIA SILIUS, Cagliari; Contini	Study of a support method for the economic working of a deposit below the 'critical' (self-supporting) depth
029 NL	TECHNISCHE RIJKS HOGESCHOOL, Delft; Velzeboer	Project Deep Mining
065 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Brown	Estimation of water flows into underground mines

Topic 32: HIGH-GRADE — LOW TONNAGE DEPOSITS

127 D	KHD ENGINEERING GmbH, Köln; Cordes	Transportable plants for the beneficiation of ores from small deposits with high-grade ore
024 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; de Coussemaker	Technology for exploiting high grade, low tonnage deposits by using mobile or specially adapted plant
100 I	UNIVERSITA DI CAGLIARI, IST. DI ARTE MINERARIA; Carta	Optimization of exploitation methods

LIST OF PATENTS

1978-1981

095-79 MPPI — Istituto per il Trattamento dei Minerali
CNR
Roma

- Hydrometallurgical process for separating Pb/Zn from oxidized ores

MPP 138 I — Istituto per il Trattamento dei Minerali
CNR
Roma

- Processo per la flottazione del Rutilo con N-Benzoil-N-Fenil Idrossilammina

096-79 MPP I — Alluminio Italia
Roma

- Direct production of Al/Si alloys from leucites

020-79 MPP F — Minemet Recherche
Paris

- Improvement of lead recovery and concdentrate quality of fine sulphide ores

021-79 MPP F — ARMINES
Paris

- Study of the action of picks and discs in mining machines by small scale models

115 MPP I
(3 brevets) — SAMIM
Roma

- Recovery of metals (Pb, Zn, Cu and others) contained in slags by non-conventional hydrometallurgical processes, high temperature chlorination and others

058-79 MPP UK — University of Manchester
Manchester

- A method of forming emulsions in continuous flow liquid membrane extraction processes.

LIST OF PROJECTS

R&D PROGRAMME IN THE RAW MATERIALS SECTOR
(Indirect action)
1982-85

I. EXPLORATION R&D

Topic 1.1.: Geology of Ore Deposits and of their host rocks

005 D	TECHNISCHE UNIVERSITÄT, München, Morteani	Development of petrological and geochemical criteria for the search for Nb and P rich carbonatites
010 D	UNIVERSITÄT HEIDELBERG, Heidelberg, ; Wauschkuhn	Petrographic and geochemical indicators for the exploration of concealed ore deposits in sedimentary rocks
015 D	RHEINISCH-WESTFÄLISCHE TECH., HOCHSCHULE, Aachen; Friedrich	Investigation of sulfide mineralisation and hydrothermal alterations in drill-hole CY-2, Cyprus Crustal Study Project
016 D	UNIVERSITÄT TÜBINGEN, Tübingen; Friedrichsen	Cyprus Crustal Study Project (drill-hole CY-2): Development of geochemical methods for the exploration of massive sulfide ore deposits of the Troodos type
017 D	JUSTUS LIEBIG UNIVERSITÄT, Giessen; Emmermann	Cyprus Crustal Study Project (drill-hole CY-2): trace elements in sulfides and alteration products of ophiolites as guides to mineralisation
018 D	RUHR UNIVERSITÄT, Bochum; Schmincke	Cyprus Crustal Study Project (drill-hole CY-2): Analysis of volcanic and hydrothermal processes leading to massive sulphide formation in the Troodos ophiolite
023 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Johan	Platinoids supply to the EEC: prospecting guides for P.G.E. in layered complexes and ophiolites
031 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Le Bel	Tungsten deposits in Western Europe: development of a geochemical approach of general applicability in mineral exploration
032 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Fouillac	Metals behaviour in hydrothermal solutions of oceanic ridges (Geothermal drilling of Djibouti)
036 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Toulouse; Prouhet	Distribution of tungsten deposits in and around intrusive granites. Redistribution of the tungsten in soils
038 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans: Johan	Determination of the factors controlling chromite mineralisation, with special emphasis on aids to mineral exploration
040 F	ARMINES, St. Etienne; Fonteilles, Guy	Tungsten deposits in Western Europe: development of a geochemical approach of general applicability in mineral exploration
041 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Sureau	Petrographic and geochemical indicators for the exploration of concealed ore deposits in sedimentary rocks
128 F	UNIVERSITE PAUL SABATIER, Toulouse; Tollon	Metallogenesis and guides for mineral exploration in the Cambrian and Ordovician of Montagne Noire (SW France) and Sardinia
130 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Monthel	Metallogenesis and guides for mineral exploration in the Cambrian and Ordovician of Montagne Noire (SW France) and Sardinia
051 I	UNIVERSITA DEGLI STUDI DI CAGLIARI, Cagliari; Violo, Tocco	Mixed sulphides mineralisations in the Paleozoic of Sardinia. Metallogenic evolution from the Cambrian shelf to the Ordovician-Silurian active paleomargin
061 I	ENTE MINERARIO SICILIANO, Palermo; Decima	Scheelite and associated ores in the metamorphic rocks of the Peloritani Mountains, N. E. Sicily
067 I	ENTE MIN. SARDO, PROGEMISA S. p. A., UNIV. CAGLIARI, Cagliari; Marcello, Salvadori	Tertiary manganese deposits of Sardinia
131 I	UNIVERSITA DI MESSINA, Messina; Villari	New concepts in mineral exploration philosophy and their use in the study of different types of polymetallic mineralisation in the Rhodope region, Greece
132 NL	RIJKSUNIVERSITEIT UTRECHT, Utrecht; Schulling	New concepts in mineral exploration philosophy and their use in the study of different types of polymetallic mineralisation in the Rhodope region, Greece
076 B	KATHOLIEKE UNIVERSITEIT LEUVEN, Heverlee; Viaene	Sediment petrographic of lower carboniferous sediments in the Navan area (Ireland) and its relationship to lithogeochemistry and base metal mineralisation
078 B	SERVICE GEOLOGIQUE DE BELGIQUE, Bruxelles; Dejonghe	Petrographic and geochemical indicators for the exploration of concealed ore deposits in sedimentary rocks
079 B	FACULTE POLYTECHNIQUE DE MONS, Mons; Robaszynski	Stratabound phosphate deposits of Belgium
127 B	UNIVERSITE CATHOLIQUE DE LOUVAIN, Louvain-la-Neuve; Verkaeren	Scheelite deposits in Western Europe: development of a geochemical approach of general applicability in mineral exploration

089 UK	THE OPEN UNIVERSITY, Milton Keynes; Prichard	Development of techniques for the determination of the platinum group elements in ultramafic rock complexes of potential economic significance: mineralogical studies
098 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUTE OF GEOLOGICAL SCIENCES, London; Notholt	Geology and economic potential of low grade igneous phosphate rocks
102 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUTE OF GEOLOGICAL SCIENCES, London; Shepherd	Fluid inclusion chemistry
108 UK	THE OPEN UNIVERSITY, Milton Keynes; Gass, Neary	Determination of the factors controlling chromite mineralisation, with special emphasis on aids to mineral exploration
124 UK	UNIVERSITY OF SOUTHAMPTON, Southampton; Nesbitt	New concepts in mineral exploration philosophy and their use in the study of different types of polymetallic mineralisation in the Rhodope region, Greece
110 EIR	GEOLOGICAL SURVEY OF IRELAND, Dublin; McArdle	The application of isotope techniques in the development of an exploration strategy
116 DK	KOEBENHAVNS UNIVERSITET, Copenhagen; Makovicky, Rose-Hansen	Solubility and distribution of platinum-group-elements in base metal sulphides contained in PGE deposits
117 DK	AARHUS UNIVERSITET, Aarhus; Schönwandt	Exploration for disseminated high tonnage molybdenum deposits
118 DK	GROENLANDS GEOLOGISKE UNDERSOEGELSE, Copenhagen; Steenfelt	Pyrochlore in alkaline intrusions in Greenland
119 DK	GROENLANDS GEOLOGISKE UNDERSOEGELSE, Copenhagen; Secher	Apatite mineralization in carbonatite intrusions in Greenland
120 DK	KOBENHAVNS UNIVERSITET, Copenhagen; Ghisler	Determination of factors controlling chromite mineralization with special emphasis on aids to mineral exploration
122 GR	INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION, Athens; Perissoratis	Marine geological research for placer deposits in the offshore areas of Eastern Macedonia and Thraki, N. Greece
133 GR	INSTITUTE OF GEOLOGY AND MINERAL EXPLORATION, Athens; Constantinides	New concepts in mineral exploration philosophy and their use in the study of different types of polymetallic mineralisation in the Rhodope region, Greece

Topic 1.2: Geochemical methods

001 D	BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE, Hannover; Van den Boom	Development and application of gasgeochemical exploration methods
008 D	HAHN-MEITNER INSTITUT FÜR KERNFORSCHUNG, Berlin; Möller	Litho-geochemical proximity indicators for stratabound base metal deposits
014 D	GELSENBERG A. G. — Mineralien, Kassel; Dasen, Werner	Strataform base metal deposits in the Rheinisch Massif
035 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Wilhelm	The chemical dispersion of metals in soils and stream sediments
042 F	BUREAU DE RECHERCHE GEOLOGIQUES ET MINIERES, Orléans; Degranges	Application of soil gas analyses in prospecting for concealed deposits
073 NL	RIJKSUNIVERSITEIT UTRECHT, Utrecht; Schuiling	Integral rock analysis, a new approach to lithogeochemical exploration
074 NL	RIJKSUNIVERSITEIT UTRECHT, Utrecht; Oosterom	Application of lithogeochemical parameters and models to the exploration of tungsten and associated ore deposits
077 B	FACULTE POLYTECHNIQUE DE MONS, Mons; Charlet	Induced thermoluminescence of quartz as an indicator of mineralisations
090 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUT OF GEOLOGICAL SCIENCES, London; Plant	Exploration criteria for buried mineral deposits based on new metallogenic models
096 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUTE OF GEOLOGICAL SCIENCES, Exeter; Beer	Geochemical recognition of hidden granites and associated tungsten mineralisation
100 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUTE OF GEOLOGICAL SCIENCES, Nottingham; Ball	The behaviour of components of soil air as a guide to a detection of buried ore bodies
104 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUTE OF GEOLOGICAL SCIENCES, London; Moore, Gray	Application of plasma source mass spectrometry to mineral exploration
105 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Cronan	Development of geochemical exploration techniques for locating submarine mineral deposits
106 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Ferguson	The role of light hydrocarbon gases in mineral exploration within the European Community, with particular reference to lead and zinc mineralisation in carbonate host rocks
109 EIR	IRISH BASE METALS, Dublin; Meldrum	The geochemistry of lower carboniferous sediments in Ireland, its relationship to base metal deposits and applicability to the search for concealed deposits

Topic 1.3.: Geophysical methods

003 D	PREUSSAG AG-METALL, Goslar, Broicher	UV Laser prospecting. Investigation of laser-induced fluorescence of minerals
007 D	WESTFÄLISCHE BERGGEWERKSCHAFTSKASSE, Bochum; Schepers	Development of very high resolution reflection seismic data acquisition, processing, and inversion methods for the exploration of mineral deposits
009 D	BUNDESANSTALT FÜR GEOWISSENSCHAFTEN UND ROHSTOFFE, Hannover; Greinwald	Testing of newly developed measuring and interpretation techniques for the TEM method
101 D	NIEDERSÄCHSICHES LANDESAMT, Hannover; Mundry	Combined d. c. & electromagnetic measurements for geoelectrical soundings
129 D	UNIVERSITÄT HAMBURG, Hamburg; Makris	Determination of the factors controling chromite mineralization with special emphasis on aids to mineral exploration
030 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Borsier, Pinault	Optimization of the prospection of mining elements by *in-situ* neutron activation analysis
044 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Valla	Geophysical electromagnetic equipment with a low frequency bandwidth
115 F	INSTITUT NATIONAL POLYTECHNIQUE DE LORRAINE, Vandœuvre; Pham	Detection of deep conductors around drillholes using DC and EM methods
087 UK	CAMBORNE SCHOOL OF MINES, Redruth; Kantaris	Evaluation of a V.L.F. borehole probing apparatus for the location of deep-seated ore bodies
088 UK	UNIVERSITY COLLEGE OF WALES, Aberystwyth; Phillips	Fiels scientific studies of IP & EM phase effects
097 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUTE OF GEOLOGICAL SCIENCES, Nottingham; Ogilvy	Appraisal of transient electromagnetic method for deep ore detection
099 UK	NATURAL ENVIRONMENT RESEARCH COUNCIL — INSTITUTE OF GEOLOGICAL SCIENCES, Nottingham; Ogilvy	Development of three dimensional inter-borehole IP Techniques

Topic 1.4.: Remote sensing

037 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Scanvic, Weecksteen	Structural, geochemical and subsurface applications of remote sensing to hidden deposits
071 NL	INTERNATIONAL INSTITUUT VOOR LUCHTKAARTERING EN AARDKUNDE, Enschede; Koopmans	Application of Multiband SAR Imagery in exploration of mineralised areas in the Pyrite Belt, Sw. Spain (Project SARTHI)
111 EIR	THE UNIVERSITY OF DUBLIN, Dublin: Phillips	Correlation of geological, geochemical and geophysical data with satellite imagery, north-central Ireland
114 DK	DANMARKS TEKNISKE HOEJSKOLE, Lyngby; Conradsen	The use of structural and spectral enhancement of remote sensing data in ore prospecting

Topic 1.6.: Statistics and Geostatistics Applied to Exploration Data

045 F	INSTITUT NATIONAL POLYTECHNIQUE DE LORRAINE, Nancy; Mallet	A computer assisted concept in ore prospection and reserves estimation
113 DK	NORDISK MINESELSKAB, Copenhagen; Pedersen	Vein-type tungsten and antimony mineralisation in Central East Greenland

ORE PROCESSING

Topic 2.1.: Complex Lead, Zinc and Copper Ores

002 D	LURGI CHEMIE UND HÜTTENTECHNIK GmbH, Frankfurt; Pietsch	Hydrometallurgical treatment of sulphidic complex ores
006 D	STUDIENGESELLSCHAFT FÜR EISENERZAUFBEREITUNG, Liebenburg; Burghardt	Gravimetric separation of ores in the 2.0-0.1 mm fraction by means of heavy media
012 D	SACHTLEBEN BERGBAU GmbH, Lennestadt; Heide	Improvement of flotation techniques for high pyritic complex Pb/Zn Meggen ore
020 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Bloise	Recovery of elemental sulphur and metals from pyritic ores application to Rouez
022 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Bloise	Direct leaching of complex pyritic ores with selective dissolution of the non-ferrous metals
024 F	MINEMET RECHERCHE, Trappes; Cardini	Improvements for a hydrometallurgical process well adapted to the copper bearing ore of Corvo
025 F	MINEMET RECHERCHE, Trappes; Fossi	Cuprous materials beneficiation in an hydrometallurgical zinc plant
028 F	MINEMET RECHERCHE, Trappes; Predali	Pilot grinding and conditioning for metal recovery improvement by flotation of complex ores

029 F	MINEMET RECHERCHE, Trappes; Georgeux	Direct leaching of pyritic complex ores with selective dissolution of non-ferrous metals
039 F	SOCIETE NATIONALE ELF AQUITAINE, Artix; Mathieu	Obtaining elemental sulphur and metals from pyritic ores
046 F	INSTITUT NATIONAL POLYTECHNIQUE DE LORRAINE/CENTRE DE RECHERCHE SUR LA VALORISATION DES MINERAIS, Vandœuvre Cédex; Blazy	Purification and recovery of metals from concentrated acid solutions by ion precipitate flotation techniques
047 F	INSTITUT NATIONAL POLYTECHNIQUE DE LORRAINE/CENTRE DE RECHERCHE SUR LA VALORISATION DES MINERAIS, Vandœuvre Cédex; Cases	Beneficiation of finely disseminated complex sulphide ores; Study of slime-coating and collection
048 F	ARMINES, Fontainebleau; Gaunand	Iron extraction from complex ore leach liquors in a three-phase mixer
049 F	L'AIR LIQUIDE, Sassenage; Dumas	Iron precipitation by oxygen in acid cupric chloride solutions from complex ores leaching
070 I	CONSIGLIO NAZIONALE DELLE RICERCHE, Roma; Marabini	Processing of oxidized lead-zinc ores with new flotation and leaching procedures
072 NL	ENKA B. V., Arnhem; Kater	Modified polysaccharides to promote the flotation of low grade sulphidic ores and phosphate
092 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Shergold	Application of new recovery techniques to the separation of fine mineral particles
093 UK	WARREN SPRING LABORATORY, Stevenage; Watson	Application of new recovery techniques to the separation of fine mineral particles
094 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Monhemius	Iron removal from complex ore leach liquors by hydrolytic stripping
107 UK	WARREN SPRING LABORATORY, Stevenage; Flett	*In-situ* leaching laboratory simulation and modelling studies phase 2
112 EIR	INST. FOR INDUSTRIAL RESEARCH AND STANDARDS, Dublin; Burton	Continuation of programme on *in-situ* leaching mining technology
121 GR	PROJECT STUDIES & MINING DEV. CORP., Athens; Simos	Beneficiation of low grade smithsonite and calamine-deposits
123 GR	AEGEAN METALLURGICAL INDUSTRIES; Athens; Moussoulos	Dearsenification of auriargentiferous pyrite cinders and recovery of gold and silver
Topic 2.2.: Other Complex and Oxidised Ores		
027 F	MINEMET RECHERCHE, Trappes; de Bascoche	Increase in the availability of cobalt co-produced with nickel industrial plant
060 I	SOC. MINERARIA E METALLURGICA PERTULOSA, Roma; Brusca	Valorisation of tungsten ore (scheelite) associated to magnetite bodies in Traversella deposit
063 I	CENTRO STUDI GEOMINERARI E MINERALURGICI DEL CNR, Cagliari; Del Fà	Evaluation of Sardinian placers and beneficiation possibilities of their heavy minerals
081 UK	TIOXIDE INTERNATIONAL, Stockton-on-Tees; Moody	Beneficiation of complex titanium ores (Ilmenitic minerals)
103 UK	CHARTER CONSOLIDATED SERVICES, Ashford; Chaston	Engineering of a chloride roasting process for recovering tin from complex ores and residues
125 GR	NATIONAL TECHNICAL UNIVERSITY OF ATHENS, Athens; Kontopoulos	Recovery of nickel and cobalt from laterites by sulphuric acide leaching at atmospheric pressure
126 GR	NATIONAL TECHNICAL UNIVERSITY OF ATHENS, Athens; Frangiskos	Beneficiation of low-grade Ni-laterites
Topic 2.3.: Aluminium from Low-Grade Sources		
004 D	VEREINIGTE ALUMINIUM-WERKE, Bonn; Kämpf	Extraction of alumina from diasporic Greek bauxites
064 I	ALUMINIO ITALIA, Porto Marghera; Landi	Study on the direct carbothermic reduction process by an arc furnace pilot plant of poor aluminous minerals and processing residues, along or mixed. Feasibility study of the final purification process. Preliminary comparison tests on lab. scale of a blast furnace type reduction process
Topic 2.4.: Chromium from Low-Grade Sources		
091 UK	LAPORTE INDUSTRIES Ltd., Grimsby; Robinson	Evaluation of European chromite ore in the chloride process for chromium recovery

Topic 2.5.: Phosphates

085 UK	WARREN SPRING LABORATORY, Stevenage; Hickey	Treatment of low grade igneous phosphate from the North Atlantic igneous province

Topic 2.6.: Slags and Residues from Metallurgical Processing

026 F	MINEMET RECHERCHE, Trappes; Demarthe	Recovery of lead, copper, silver and associated metals contained in zinc plant residues
058 I	PERTULOSA SUD, Crotone; Sambarino	Recovery of lead, copper, silver and associated metals contained in zinc plants residues
059 I	PERTULOSA SUD, Crotone; Sambarino	Cuprous materials beneficiation in an hydrometallurgical plant
082 UK	TIOXIDE INTERNATIONAL, Stockton-on-Tees; Moody	Recovery of valuable metals from the TiO2 production process

Topic 2.7.: Modelling and Control in Mineral Processing

021 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Bloise	Development and test of models to predict and improve performances of industrial flotation plants
075 B	UNIV. LIBRE DE BRUXELLES, Bruxelles; Panou	Modelisation of the ore processing operations
083 UK	WARREN SPRING LABORATORY, Stevenage; Cutting	Tin concentration by gravity methods: prediction of the operational performance
084 UK	WARREN SPRING LABORATORY, Stevenage; Cutting	Development of a simulation package for mineral processing plant design
086 UK	WARREN SPRING LABORATORY, Stevenage; Cutting	Development and verification of models to improve the performance of flotation plants

Topic 2.8.: Improved Mineralogical Analysis

043 F	BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, Orléans; Remond	Electron spectroscopic analyses of contaminated ZnS by heavy ions
095 UK	IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, London; Jones	Further development of automatic methods of mineralogical measurement

MINING TECHNOLOGY

Topic 3.1.: Problems Associated with Depth

011 D	TECHNISCHE UNIVERSITÄT BERLIN, Berlin; Wilke	Electronic data processing (EDP) model studies to optimise mining operations with cemented backfill in base metal mining
013 D	SACHTLEBEN BERGBAU GmbH, Lennestadt; Harnischmacher	Mining with cemented fill to reduce rock damage within the mine and on the surface
050 F	ARMINES, Paris; Tincelin	Influence of type of fill and of its setting underground on the stability of mining structures
052 I	SOCIETA TALCO E GRAFITE VAL CHISONE S. p. A. Pinerolo; Longo	Research of an improvement of the mining stability of conditions by means of the 'downward horizontal slices and hangingwall rock concrete backfilling' mining method
062 I	POLITECNICO DI TORINO, Torino; Pellizza	Criteria for the application of loose and cemented fill in mining to improve safety and recovery
069 I	UNIVERSITA DEGLI STUDI DI ROMA, Roma; Bilardo	Vertical lift of coarse grained ores in two or three phase flow

Topic 3.3.: Geostatistics and Modelling in Mineral Exploitation

033 F	ARMINES, Paris; Deraisme	Development of a computer software for the simulation of mining operations in open pit mines

LIST OF DOCUMENTS

Community R&D Policy

. A scientific and technical Strategy for Europe - Framework Programme - 1984-1987 XII/126/84, Jan. 1984

. Community Research and Development and Demonstration Activities, 1.3.1984

. Working together - the Institutions of the European Community - ISBN92-825-0571-5 (graphs only)

. Organigramme DG XII + JRC

Evaluation of R&D Programmes

. Council Resolution concerning a Community plan of action on the evaluation of Community R&D programmes (O.J. C 213 p. 1 dated 3.8.1983)

. Evaluation of the European Community's radiation protection research programme. Research Evaluation report n° 8 EUR 8648

Research and Development programme in the raw materials sector

. COM(77)284 final - 24.6.1977 : Proposal for a multiannual R&D programme in the field of primary raw materials (indirect action)(1978-1981)

. Council Decision adopting a multiannual R&D programme (1978-1981) for the European Economic Community in the field of primary raw materials (indirect action)(O.J. n° 272/9 dated 14.3.19978)

. Information on research contracts of the primary raw materials R&D programme (indirect action) (1978-1981) - July 1981

. Final reports (XII/MPP/14/84) - Primary Raw Materials - R&D Programme 1978-1981

. XII/1269/80/EN : Background document to the proposal of the second programme (1982-1985)

. COM(81)281 final - 17.6.1981 : Multiannual R&D programme of the European Communities in the sector of Raw Materials (1982-1985)

. Council Decision of 17.5.1982 adopting a research and development programme (1982 to 1985) in the raw materials sector (O.J. L 174/25)

. Preliminary information on contracts - July 1983 - R&D Programme in the Raw Materials sector (indirect action) (1982-1985)

. Meetings Primary Raw Materials Programme (Steering Committee)

. Draft reports of the meetings of the Advisory Committee on Programme Management in Primary Raw Materials R&D (7 meetings : from July 1978 to November 1981)

. Information memo for CREST : Status of the R&D programme in the Raw Materials sector (1982-1985)(XII/733/83-EN - 15.9.1983)

. Liste des Brevets

. Summary final reports
- Topics : . Economic Geology
. Geochemical Methods
. Remote Sensing

. Final reports contracts n° : 043B, 127D, 128D, 105D, 001D, 107D, 002D, 003D, 035D, 005D, 123DK, 079DK, 112DK, 126EIR, 072EIR, 159EIR, 023F, 020F, 022F, 133F, 014F, 008F, 080F, 083F, 084F, 088F, 136F, 062UK, 032UK, 039UK, 041UK, 043UK, 059UK, 054UK, 121UK, 045UK, 116UK, 057UK, 058UK, 152NL, 154NL, 093I, 096I, 141I

. Notes prepared by invited project leaders and distributed during the meeting 003D, 093I, 096I, 005D, 115I, 058UK, 073EIR, 116UK, 112DK, 080F, 083F, 084F, 088F, 087F, 001D, 043UK, 107D

. Council Resolution of 14 January 1974 and Terms of Reference of CREST

. Terms of Reference of the CREST Subcommittee on Raw Materials R&D

. Membership of the ACPM

Working documents

. List of panel members

. Terms of reference

. Questionnaires

. Minutes of the meetings

. List of main topics and questions to be covered during the interviews of invited project leaders

EVALUATION OF THE COMMUNITY'S R&D PROGRAMMES

IN THE FIELD OF PRIMARY MINERAL RAW MATERIALS

(1978-81)

QUESTIONNAIRE FOR CONTRACTORS

Fields addressed

I. Added value of Community R&D programmes

II. Scientific/technical aspects

III. Potential applications and spin-off of research results

IV. Programme management aspects

V. Financial aspects

VI. National/international cooperation

VII. Dissemination of information

VIII. Programmatic aspects

IX. Any comments of a general or specific nature

— Contract reference: .....

— Type of institution:
- university .....
- national institutions/ geological surveys .....
- industry .....
- other .....

— Country:

Please return the questionnaire to the chairman of the evaluation panel: _____

CEC: Commission of the European Communities

I.

I. Added value of the Community's R&D programme *vis-à-vis* parallel independent national activities.

General comments

1. Do you consider that the Community R&D programme in your field has contributed to

☐ Progressive establishment of **close** and **fruitful** links among interested experts from different Member States

☐ Avoidance of duplication of efforts

☐ Better utilization of research facilities

☐ Time savings (general accelerations of scientific and technical progress). . .

☐ Sharing of tasks according to specialisation/joint projects

☐ Feedback of results and utilization of research findings among contractors and other scientists

☐ Other, please specify

Specific comments

1. Did the Community's research programmes in the field of Primary Mineral Raw Materials create, maintain, or expand the research capacity of your organisation in the field?

2. During the period 1978-1981 under review, to what extent did the CEC financial support effectively increase the available R&D funds. Did your research institution/company

☐ (a) make available additional funds in response to the CEC's decision to support your research proposal?
☐ (b) maintain the national contribution at the level which would have been reached in the absence of a favourable CEC decision?
☐ (c) reduce the national funds as a result of the CEC financial support?

Please estimate size of the effect, if possible.

3. How many staff were involved in your contract, approximate time allocation in percentage
- scientists and engineers
- postgraduate students
- undergraduate students
- technicians + others

II.

4. What was your principal motivation for submitting a research proposal?

5. (a) Did your work proceed according to schedule with regard
   - to timing
   - to nature/quality of the results?

   (b) Did you meet any special difficulties of whatever nature?
   (c) If yes what, were the consequences of these difficulties on the conduct of the R&D work?

6. To what extent do you consider that the objectives of your research — either originally set or subsequently modified — have been reached?

7. Did you benefit from the CEC support other than financially? Please explain.

III.

8. In your field what do you consider to have been the main applications/benefits of your research results?

9. Are there any benefits/applications of your research results in other fields as well?

10. What kind of people/organisations are most likely to apply/use your results? Can you name examples of such people/organisations?

IV.

General comments

Please give an assessment on the effectiveness of management and coordination of the programme by giving your comments on the following chain of events:

- Call for proposals
- Technical evaluation of projects
- Monitoring and follow-up of projects
- Rules for exchange of information, confidentiality of data, reporting requirements, etc.
- Promotion of collaboration, be it among Universities, laboratories, industries, etc.

Specific comments

11. (a) Was your contract let in a timely manner? If not, what do you consider to have been the reasons due to the Commission or to your organisation?
    (b) What were the consequences of any contract letting delays on the execution of your work?

12. Was your work followed and reviewed by the CEC during the definition and the execution phases of your contract?
    (a) What interactions did you have (discussions with CEC management staff; site visits by CEC staff, contractor meetings, seminars/symposia /conferences, progress and final report requirements, others (please specifiy)?
    (b) Did and, if yes, how did these interactions affect the content and the conduct of your research work?
    (c) Do you consider these interactions to have been useful for your research? How could these interactions be improved?
    (d) Did the CEC staff react to your satisfaction to any special requests from your side or to difficulties you reported?

13. In your view did the early circulation/dissemination of information and overall programme results among the contractors in your field work satisfactorily?

14. What is your opinion on the management in general of your contract — including both scientific and contractual/administrative aspects — by the CEC? Are there specific facets that should be strengthened or improved?

V.

15. Do you have any comments on the level of financial support to contractors (e.g. % contribution for each project)?

VI.

16. (a) Was your contract with the CEC of a bilateral nature (CEC and your organisation) or of a multilateral nature (CEC, yours and other organisations)?
    (b) Would you see advantages in broader multilateral arrangements? Please explain.

17. (a) In the framework of your contract did you establish new contacts with:
    - CEC — contractors or other research workers in your country?
    - research staff, specialists or organisations in other EC Member States?

    (b) Were these contacts intensive or of a more superficial nature?

18. Did the CEC contract allow you to establish professional contacts across national borders beyond those established in the framework of your contract?

VII.

19. Have you any comments on the CEC's initiatives (organisation of/participation in international symposia/conferences/etc.; publications) aiming at the dissemination of the research results of the Community's programme on a broad scale?

20. Much worldwide research work is in progress in the raw materials field. Are you reasonably well informed on internationally ongoing research in the sector you are interested in? Could CEC be helpful — and, if yes, how — in solving any problems you see in relation with substantial information gaps?

VIII.

21. Taking into account the international dimension of R&D work in the field of primary mineral raw materials
    (a) Do you consider that your national R&D programme, if any, should cover all the aspects and problem areas?
    (b) To what extent do you consider that you can rely on the results and know-how acquired through R&D work carried out by CEC contractors in other countries?
    (c) Do you consider that the CEC research programme in your field should be more selective or fully comprehensive?

22. In your view what should be the main function of the Community's research programme in the field of primary mineral raw materials in relation to national research programmes? Does it presently fulfil this function?

23. Do you have any suggestions related to the developments or reorientation of the Community's research programme on Primary Mineral Raw Materials?

IX.

24. Should you have any other comments or suggestions of a general or specific nature, related to any aspect of the programme, please write them down here.

LIST OF EXPERTS INTERVIEWED BY THE EVALUATION PANEL

1. Commission staff

DG XII Messrs. Bourdeau
Donato
Boissonnas
Bram
Schmidt
Van Wambeke

DG III Mr. Nicholai

2. Advisory Committees

ACPM on Raw Materials
Chairman : Prof. Kursten

CREST Sub-committee on R&D Raw Materials
Chairman : Mr. Lautel

Advisory Committee on Programme Management :
Chairman : Prof. Pauly

3. Contractors

Messrs. Bello (096 I)
Burghardt (003 D)
Conradsen (112 DK, 79 DK)
D'Altilia
Davies (058 UK)
Fonteilles (080 F)
Friedrich (107 D)
Guarascio (093 I)
Heide (005 D)
Inamdar (073 EIR)
Martin-Kaye (116 UK)
Neary (043 UK, 121 UK, 122 F, 123 UK)
Sambarino (115 I)
Van den Boom (001 D)
Wilhelm (083 F, 084 F, 088 F, 087 F)

Annex 4.7
Table I

PRIMARY RAW MATERIALS R&D PROGRAMME (1978-1981)

	Budget	% total budget	Number of projects
EXPLORATION	**7.496.414**	**48,35**	**87**
Topic 11 : Concealed Deposits	2.905.678	18,70	33
Topic 12 : Prospection Methods	4.590.736	29,60	54
ORE PROCESSING	**6.891.299**	**44,45**	**41**
Topic 20 : Specific Ore Processing	1.841.733	11,90	16
Topic 21 : In Situ Leaching	482.592	3,10	4
Topic 22 : Alumina from Non-Bauxite Sources	1.633.351	10,5	6
Topic 23 : Complex Pb-Zn-Ore	2.441.663	15,80	14
Topic 24 : Chlorination	491.960	3,20	1
MINING TECHNOLOGY	**1.116.714**	**7,20**	**13**
Topic 31 : Deep Deposits	909.805	5,90	10
Topic 32 : High Grade Deposits	206.909	1,30	3
TOTAL	15.504.427		141

Annex 4.7
Table II

PRIMARY RAW MATERIALS R&D PROGRAMME (1978-1981)

Breakdown of project by subtopic

	Number of projects
EXPLORATION	**87**
Topic 11 : Concealed Deposits	33
- Volcanogenic deposits	3
- Hydrothermal deposits	3
- Stratiform deposits	3
- Skarn deposits	2
- General methodology	10
- Geochemical control	9
- Structural control	3
Topic 12 : Prospecting Methods and Techniques	54
Topic 12.10 : Geochemical Methods	22
- Detailed geochemical prospecting methods	7
- Regional geochemical prospecting	5
- Study of volatiles/soil gases	3
- Hydrogeochemistry	3
- Dispersion halo studies	2
- New analytical methods	2
Topic 12.20 : Geophysical Methods	21
- Airborne techniques	2
- Ground techniques	10
- Bore-hole techniques	9
Topic 12.30 : Remote Sensing	9
- Literature review	1
- Landsat MSS data for mineral exploration in Greenland	3
- Landsat MSS for hidden cupola detection	1
- Microwave techniques	2
- Computer correlation of multi-data sets	2
Topic 12.40 : Drilling Techniques	2
ORE PROCESSING	**41**
Topic 20 : Specific Ore Processing and Metal recovery	16
- Heavy media separation	1
- Liquid membrane separation	2
- General extraction techniques	5
- Hydro-metallurgical separation	1
- Mathematical modelling	4
- Mineralogical studies	3
Topic 21 : In Situ Leaching	4
Topic 22 : Alumina from Non-Bauxite Sources	6
Topic 23 : Complex Lead-Zinc-Ores	14
- Plant optimisation	2
- Hydro-metallurgy	5
- Flotation	4
- General techniques	3
Topic 24 : Chlorination	1
MINING TECHNOLOGY	**13**
Topic 31 : Deep Deposits	10
- Geotechnical studies	5
- Water ingress studies	2
- General mining methods	3
Topic 32 : High Grade Deposits	3

European Communities — Commission

EUR 10191 — Evaluation of the Community's primary mineral raw materials programme

F. K. List, J. Bouladon, P. Brück, G. Ferrara, K. J. Sangster

Luxembourg: Office for Official Publications of the European Communities

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This report summarizes the findings of the external panel of experts set up to evaluate the Community R&D programme in the field of 'primary raw materials' (1978-81) as well as to review the partial results of the 'metal and mineral substances' sub-programme of the current shared-cost action on 'raw materials' (1982-85).

The evaluation covers mainly the scientific and technical achievements of the programme (quality and practical relevance of the results, possible spin-offs) and the contribution of the programme to Community objectives. The effectiveness of the management and coordination of the programmes including the operational structure and the choice of areas are also assessed. Finally, a number of recommendations are given for the future orientation of the programme.

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