

WHAT KIND OF INSTITUTIONAL ARRANGEMENTS
FOR MANAGING SPACE MINERAL RESOURCE ACTIVITIES SHOULD BE
DONE IN A FORESEEABLE FUTURE ?

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Abstract

The purpose of this paper is to explore the problem whether some institutional arrangements to govern management of space resource activities should be made and, in the case of a positive answer, what kind of arrangements should be concluded in a foreseeable future. While space resource activities must be seen as a very wide term which covers diverging categories of resources, this examination concentrates on mineral resource activities which may be expected to be performed on the Moon and other celestial bodies close to the Earth. The present state of law relating to this issue is characterized by rather rudimentary tools which are not likely to satisfy the future needs. The up-to-date experience from other fields of resource activities in the Global Commons for which specific arrangements have already been attempted, such as

the Area of the seabed and ocean floor beyond the limits of national jurisdiction and Antarctica, is assessed in order to ascertain whether these examples could be used for establishing an appropriate mechanism for managing resource activities on the Moon and other celestial bodies of the Solar system. Based on the characteristics of the legal regulation of activities in these areas, and an analysis of similarities and differences between their respective regimes, the following conclusions are suggested: Unlike other areas of the Global Commons, the institutional arrangements to govern the exploitation of space mineral resources might be rather modest and flexible in the beginning, to be further developed in accordance with the attainability of these resources, the real growth of the activities concerned and the role of States and other entities involved. An appropriate time frame seems to be the first quarter of the 21st century in which new significant horizons for the progressive development of international space law, to be effected hand-in-hand with the progress in space activities, will be opened.

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Introduction

As observed by an eminent international lawyer, Sir Arthur Watts, in his monograph on the Antarctic Treaty System, "[t]he international management of resources is an important and developing area of the law. As the global pressure on resources grows, their rational use and management becomes one of the most urgent needs of the international community." According to his view, "[w]hat the Antarctic Treaty system has done, ... is to build up, piece by piece, a regulatory system covering virtually all resources in the area with which it is concerned, which when completed will result in a comprehensive and interrelated system of international resource management. In doing so, it has taken a number of pioneering decisions which contribute significantly to the international community's attempts to devise effective regimes for the management of increasingly scarce resources."

The purpose of this paper is to explore the problem whether, or to what extent, such pioneering decisions on devising an effective regime for the management of resources have been made in relation to outer space and the resources which might be derived from this vast area. If not, what steps could be expected in a foreseeable future? While "space resource activities" can be interpreted as a wide term encompassing different categories of resources, this examination will concentrate on mineral resources that are expected to be available from the celestial bodies relatively close to the Earth. In particular, attention will be paid to the problem whether some institutional arrangements to govern management of space mineral

resource activities are to be done, and, if so, what kind of arrangements should be effected in a foreseeable future.

Due to the topical development which has been accomplished during the second half of this century, an analysis of this problem could not be successfully undertaken without regard to the other legal regimes which have been established during the same historical period. For during the process of their establishment, humanity had to face similar problems in other areas of its activities and these processes had a visible impact on the solutions of some issues which occurred in the area of outer space. The present legal regimes of Antarctica, the seabed and ocean floor, and outer space developed consecutively and to a certain extent even simultaneously. Comparable issues were considered during the process of establishing these regimes, though the discussions on these issues, and the negotiations on the respective instruments to govern the activities in each of these areas, were held at different fora and led to specific agreements in each individual case. Nevertheless, all these areas have a certain common denominator and are therefore usually designated by a single term - "Global Commons".

Antarctica

Antarctica became the first of these areas. As is generally known, the foundation of its legal regime was laid down by the Antarctic Treaty, which was signed in Washington on 1 December 1959 and entered into force on 23 June 1961. Twelve signatory States, which originally concluded this Treaty, agreed that the freedom of scientific investigation as

applied during the International Geophysical Year - a major international programme of cooperation which also included many other fields of geophysical concern - laid a basis for the continuation and development of international cooperation in that part of our planet and assumed a number of far-reaching obligations towards this goal. One of the evident features of the 1959 Treaty, however, was the lack of any provisions dealing with the natural resources of the Antarctic area. The existing territorial claims, which were not removed at the 1959 Washington Conference and were only frozen by the resulting treaty, created insurmountable obstacles to an agreement on this particular issue. Moreover, the subject of Antarctic resources was not considered too urgent at that time.

Consequently, no institutional arrangements which would specifically deal with the issue of Antarctic mineral resources, were established by the 1959 Treaty. However, wide responsibilities have been entrusted to the original Parties to the Treaty and to those States acceding to the Treaty later which have demonstrated their interest in Antarctica by conducting substantial scientific research activities in this area, such as the establishment of a scientific station or the dispatch of a scientific expedition. Representatives of these States, called "Consultative Parties", meet regularly at "Consultative Meetings" for the purpose of exchanging information, discussing matters of common interest and what is most significant, for recommending to their governments measures in furtherance of the principles and objectives of the Antarctic Treaty. During the period following the entry of the Antarctic instrument

into force, the Consultative Meetings have become a forum for elaboration of a series of important instruments on preservation and conservation of living resources in Antarctica,² and also for an attempt to regulate the Antarctic mineral resource activities by establishing an appropriate institutional mechanism for this purpose during the 1980's. This particular development will be discussed in some greater detail later.

Outer Space

As the international cooperation in Antarctica, the international cooperation relating to space exploration was born and grew up in the same cradle of the International Geophysical Year. However, unlike Antarctica, the exploration and peaceful use of outer space and celestial bodies by means of artificial space objects became immediately "a common interest of mankind as a whole" and a subject for deliberations in the United Nations as a universal organization. Only 12 days after the signature of the Antarctic Treaty, the UN General Assembly established the Committee on the Peaceful Uses of Outer Space /COPUOS/ as a permanent body which should "study practical and feasible means for giving effect to programmes in the peaceful uses of outer space which could appropriately be undertaken under United Nations auspices", including, inter alia, "the nature of legal problems which may arise from the exploration of outer space".³ The COPUOS became the focal point for establishing a multilateral legal basis for the exploration and peaceful uses of outer space, the most important instrument of which is the 1967 Outer Space Treaty /OST/.⁴ According to the leading princi-

ple of this instrument, "the exploration and use of outer space, including the Moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind." The OST secured, inter alia: the freedom of exploration and use of outer space, including the Moon and other celestial bodies, and equal status of all States in such activities; the freedom of scientific investigation in this area, and the promotion of international cooperation in such investigation; free access to all areas of the Moon and other celestial bodies;⁵ and renunciation of national appropriation of outer space, including the Moon and other celestial bodies, by any means.

Similarly as the Antarctic Treaty in relation to natural resources of Antarctica, the 1967 OST does not contain any principle that would explicitly regulate those activities the purpose of which would be to explore and exploit natural resources of outer space, the Moon and other celestial bodies. At the time of elaboration of the main space law instrument, these problems still seemed to be remote and the vogue for these issues did not yet emerged. Had it happened, who knows whether the 1967 OST could have been finalized at all or at least so early. Consequently, no specific institutional arrangements for managing space resource activities were negotiated at that time. "Appropriate international consultations" provided for removing potential conflicts in space activities of the States Parties to the OST have remained a rather general concept than a developed and effective mechanism to be applied to this particular problem.

On the other hand, the absence of specific provisions concerning the resource activities cannot be interpreted as allowing any State and/or its nationals to start such activities without any regard to the principles of the OST and other provisions of the international space law. Moreover, it is not possible to accept the thesis according to which the exploitation of natural resources of the Moon /and other celestial bodies/ is now open to all, that the existing management system is decentralized and that it is up to the States to establish their own management standards or to agree bilaterally on setting forth the rules to be employed during their joint activities.⁶ International law of outer space cannot be interpreted as a complete and static system; it is developing step-by-step in accordance with the real needs arising from the scientific and technical progress, and also from the progress of human society, in accordance with the province of mankind principle, the non-appropriation by any means principle, responsibility of States for all national activities and other principles of the OST.

Seabed and Ocean Floor

Almost simultaneously with the entry into force of the OST in 1967, the interest of the world community turned to another area, namely to the seabed and ocean floor beyond the continental shelf. This area became accessible for human activities by a rapid progress in the seabed exploration and the development of the technology necessary for this purpose. In 1970, the UN General Assembly adopted a Declaration of Principles Governing the Seabed and Ocean Floor and the Subsoil There-

of Beyond the Limits of National Jurisdiction, in which not only this area but also its resources were designated as "the common heritage of mankind".⁷ Moreover, the Seabed Declaration requested that the exploration of the seabed area and the exploitation of its resources should be effected under an international regime to be established, including an appropriate international machinery.

After 12 years of further discussions and difficult negotiations, first in the UN Seabed Committee and then at several lengthy sessions of the Third UN Conference on the Law of the Sea, the United Nations Convention on the Law of the Sea was adopted and immediately signed by 119 States and other entities on 10 December 1982 at Montego Bay, Jamaica. This Convention regulates the use of all parts of the sea and the exploration and exploitation of the living and non-living resources of the sea and the seabed. It also provides for establishment of an international regime for the whole area of the seabed and ocean floor and the subsoil thereof beyond the limits of national jurisdiction /the "Area"/ which together with its resources were declared "the common heritage of mankind". Resources are defined in the Convention as "solid, liquid or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules, while when recovered from the Area, those objects are referred to as "minerals". Principles governing the Area as well as provisions on the development of resources of the Area were enshrined in the main part of the Convention, to which detailed rules on basic conditions of prospecting, exploration and exploitation were annexed.

Moreover, a new and elaborate international organization - the International Seabed Authority - with a complex structure of organs was created; its role is to organize and control activities in the Area, particularly with a view toward administering the resources of the Area. According to the Convention, the structure of the Authority should consist not only of traditional organs - the Assembly, the Council and the Secretariat; in addition to them an operational mining organ - the Enterprise - which should carry out activities in the Area directly, as well as the transporting, processing and marketing of minerals recovered from the Area, should be established. No State or natural or juridical person may claim, acquire or exercise rights with respect to minerals recovered from the Area except in accordance with the system of exploration and exploitation provided in the Convention, which is based on the principle that "activities in the Area shall be organized, carried out and controlled by the Authority on behalf of mankind as a whole". In this context it should be also mentioned that the Convention brought a comprehensive system for peaceful settlement of disputes concerning the interpretation or application of the provisions of the Convention. A special Seabed Disputes Chamber should deal with disputes arising from the application of the system provided for the activities in the Area.⁸

In spite of many compromise solutions of the problems relating to the system of exploration and exploitation of the Area and its resources, and particularly to the institutional arrangements for managing these activities, it was just Part XI of the 1982 Convention dealing with the legal regime

of the Seabed and the Seabed Authority which caused a long delay of the entry into force of this instrument. This goal was finally reached when the main obstacles in the way to ratification of or accession to the Convention by numerous States, the participation of which became necessary for an effective functioning of the seabed regime, were removed in 1994 by the Agreement Relating to Implementation of Part XI of the Convention. The 1994 Agreement did not change the system of exploration and exploitation of the seabed resources as established in principle by the Convention, but simplified the institutional arrangements in order to make all organs and subsidiary bodies of the Authority more suitable. The most significant innovations relate to the performance of the functions of the Enterprise which shall conduct its initial deep seabed mining operations through joint ventures.⁹ Since then a great deal of countries of the world, both developed and developing, have adopted the 1982 Convention and the 1994 Agreement, others are expected to do so in a foreseeable future.¹⁰

The Moon and Other Celestial Bodies

The ideas raised during the negotiations before and at the Third UN Conference on the Law of the Sea on the legal regime of the seabed and its resources also reflected during the discussions on the status of the Moon and its resources, which were held at the same time in the Legal Subcommittee of the COPUOS. For a longer time, the deliberations in this body concentrated on the issue of whether the concept of Common Heritage of Mankind should also govern the legal status of the Moon

and its resources and some appropriate institutional arrangements should be included in the draft of the Moon Agreement. After all, a compromise solution was found, which enabled the adoption of the 1979 Moon Agreement by consensus both in the COPUOS and the UN General Assembly.¹¹

Unlike the legal regime of the seabed and ocean floor in the 1982 UN Convention on the Law of the Sea, the concept of Common Heritage of Mankind in relation to the Moon and its resources was spelled out only in general terms and the real establishment of a legal regime based on this concept was postponed to an unidentified future time. No definition of mineral resources, the exploitation of which should be governed by this regime, was included in the Moon Agreement. The Parties to the Agreement only undertook "to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the Moon as such exploitation is about to become feasible." In addition, however, a number of purposes of the future international regime were enumerated, including, inter alia, "an equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the Moon, shall be given special consideration."

Another striking feature of the legal status of the Moon and its resources is the fact that the Moon Agreement requires only "the exploitation of the natural resources of the Moon" to be subject to the future international regime, while "exploration and

use" remain a right of all Parties to the Agreement which has to be exercised without discrimination of any kind, on the basis of equality and in accordance with international law and the terms of the Agreement. In this context it must be also recalled that the Moon Agreement has explicitly recognized the freedom of scientific investigation, which enables the Parties to the Agreement to collect on and remove from the Moon samples of its mineral and other substances for scientific purposes. Moreover, they "may in the course of scientific investigations also use mineral and other substances of the Moon in quantities appropriate for the support of their missions." And according to Article 9, the Parties to the Moon Agreement may establish manned and unmanned stations on the Moon, though they may use only that area which is required for the needs of the station.

Finally, still another significant feature of the legal regime designed by the 1979 Moon Agreement must be noted: Article 11, though speaking about "appropriate procedures" to be included in the future national regime of the Moon, which should eventually also apply to other celestial bodies of our Solar system, does not mention the establishment of a special institutional machinery for ensuring the application of the system of exploitation of the Moon resources, i.e. an international organization similar to that which was provided in an elaborate manner in the 1982 UN Convention on the Law of the Sea.

It is known that in spite of this compromise solution of the issue of Common Heritage of Mankind, which opened the way to the adoption of the 1979 Moon Agreement by consensus at the UN

level, only a small number of States have become Parties to this legal instrument so far. This fact probably also influenced the UN General Assembly when it was reviewing the Moon Agreement in 1994 - ten years after its entry into force - to avoid any attempts at implementing the promise to establish the "international regime, including appropriate procedures, to govern the exploitation of the natural resources of the Moon".

Antarctic Mineral Resource Activities

The negotiations on the legal regime of the seabed at the Third UN Conference on the Law of the Sea produced still another parallel effect - an attempt at a further development of the legal regime of Antarctica. Just when the new Convention on the Law of the Sea was almost finalized, a Special Consultative Meeting began to discuss the regulation of Antarctic Mineral Resource Activities; this work led to the conclusion of a Convention on this subject, which was opened for signature at Wellington on 25 November 1988.¹² The aim of this instrument was to enable and regulate prospecting, exploration and development of mineral resources of this area, which were defined as "all non-living natural renewable resources, including fossil fuels, metallic and non-metallic minerals". Moreover, the terms "prospecting", "exploration" and "development" also found their precise definitions in the Wellington Convention.¹³ On the other hand, "scientific research", the freedom of which has been secured by the 1959 Antarctic Treaty, was excluded from the content of these definitions and thus from the scope of the Convention.

In addition to principles

and stringent technical norms dealing with different stages of resource activities, the Wellington Convention also provided for an institutional machinery and a system of dispute settlement. The institutional structure should consist of the Antarctic Mineral Commission, the Scientific, Technical and Environmental Advisory Committee, the Special Meeting of Parties and the Regulatory Committees. In particular, a balance between the powers of the Regulatory Committees and the Mineral Resource Commission characterizes this structure and the role of these bodies in negotiations on the so called Management Schemes with the Operators and their Sponsoring States, which should open the way to mineral resource activities.

However, notwithstanding its adoption by consensus, the 1988 Wellington Convention lost support during the signature and ratification process, and seems to be abandoned. The 1991 Protocol on Environmental Protection to the Antarctic Treaty, which entered into force on 14 January 1998 when all 26 Antarctic Treaty Consultative Parties ratified it,¹⁴ introduced a freeze of mineral resource activities by prohibiting "any activity relating to mineral resources, other than scientific research". The prohibition shall continue "unless there is in force a binding legal regime on Antarctic mineral resource activities that includes an agreed means for determining whether, and, if so, under which conditions, any such activities would be acceptable".

Conclusions

Based on the characteristics of the legal regimes governing the mineral resource activities in all

the above-mentioned areas, and a comparative analysis of the similarities and differences between them, the following conclusions are suggested:

1. The up-to-date experience derived from such activities in the Global Commons has been rather limited. The only legal regime of this kind which has been developed so far and is becoming operative, is the system of exploration and exploitation of the resources from the Area of the seabed and ocean floor as provided in the 1982 UN Convention on the Law of the Sea. However, despite the entry of the 1982 Convention into force, this system was in fact amended by the 1994 Agreement by which its Parties tried to make the legal regime of the seabed and the Seabed Authority more acceptable for those countries, which hesitated to sign and ratify the Convention due to its original exaggerated complexity and rigidity, but an effective participation of which is essential for a successful performance of mineral resource activities in the Area. At present the implementation of this system is still at its initial stage and the real mineral activities relating to the seabed Area amount to prospecting, developing of adequate technology and other preparations for future actions. A number of further instruments to regulate these activities have been elaborated.¹⁵ On the other hand, the implementation of the legal regime provided for the Antarctic mineral resource activities by the 1988 Wellington Convention has been in fact delayed for an indefinite period of time.

2. Unlike the system provided in greater detail for the Area of the seabed and ocean floor /and also the system provided for the Antarctic area which, however,

has not become effective/, an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the Moon /and eventually other celestial bodies/ has not been elaborated. Its real establishment has been subjected to feasibility of such exploitation, but it has not been specified how a decision on such feasibility should be made and who would be competent to do so. In Article 18 of the Moon Agreement, it is only stated that the UN Secretary-General should, at the request of one third of the States Parties to the Agreement and with the concurrence of the majority of them, convene a conference of States Parties to review this Agreement. And this review conference "shall also consider the question of the implementation of the provisions of article 11, paragraph 5, on the basis of the principle referred to in paragraph 1 of that article and taking into account in particular any relevant technological developments." Under the present state of ratifications and accessions to the 1979 Moon Agreement, the application of this provision would thus mean that a review conference might be initiated by only three States Parties to the Agreement and should be convened if such initiative were endorsed by five States Parties. The conference would then be composed of nine States Parties. It must be taken into account that for the time being none of the space-faring nations which would be capable to develop mineral resource activities on the Moon or other celestial bodies in a more or less distant future, is amongst the States Parties to the Moon Agreement.

3. Provided that the exploitation of natural resources of the

Moon /and other celestial bodies/ becomes feasible and the present obstacles against the establishment of an international regime, including appropriate procedures, to govern such exploitation are removed in a foreseeable future, the institutional arrangements relating to mineral resource activities on the Moon /and other celestial bodies/ should be rather modest in the beginning, to be further developed step-by-step in accordance with attainability of these resources, the real growth and cost-effectiveness of the activities concerned, and the role of States and other entities involved in such activities.

4. An appropriate time-frame for elaboration of adequate arrangements for this purpose seems to be the first quarter of the 21st century in which new significant horizons for a further successful development of space flights and the progressive development of international space law will be opened.¹⁶ The management of space resource activities carried out for the benefit and in the interest of all countries, irrespective of their degree of economic or scientific development, will probably become one of its foremost topics. The above-mentioned time-frame would enable to choose a reasonable approach to, and a progressive build-up of, the international regime of space mineral resource activities including appropriate institutional arrangements. The experience which might be gained from the seabed mining activities during the next decades could be helpful, in order to avoid the wrongful expectations which characterized the original considerations of these issues. In this context the idea of establishing a World Space Agency might be also pondered, for such a body would be a suitable forum for managing space resources.

5. The United Nations as a competent forum for discussing such topics, and the COPUOS as its specialized body for consideration of the problems relating to international space cooperation, should be ready for facing this challenge. And the Third UN Conference on the Peaceful Uses of Outer Space to be held in Vienna in July 1999 /UNISPACE III/ might draw the attention of the world community to this subject and recommend to include its consideration in the space agenda for the 21st century.

References

1. See Sir Arthur Watts, International Law and the Antarctic Treaty System, Cambridge, 1992, p. 209.

2. See, e.g., The Agreed Measures for the Conservation of Antarctic Fauna and Flora /1964/, the Convention for the Conservation of Antarctic Seals /1972/ which entered into force on 11 March 1978, and the Convention on the Conservation of Antarctic Marine Living Resources /1980/ which entered into force on 7 April 1982. The primary aim of these instruments, however, is the protection of the living resources against the damage caused by overexploitation thereof and thus they belong more to the environmental endeavours than to the regulation of economic activities. The 1991 Protocol on Environmental Protection to the Antarctic Treaty, which also emerged from the deliberations of the Consultative Meetings, represents the most complex instrument of this series.

3. See General Assembly resolution 1472 /XIV/ of 12 December 1959.

4. See the Treaty on Principles

Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, which was opened for signature on 27 January 1967 and entered into force on 10 October the same year. Its text in United Nations Treaties and Principles on Outer Space, Doc. A/AC.105/572/Rev.2, United Nations, New York, 1997, pp. 4ff./

5. In this context, attention should be drawn to the fact that the OST declares only free access to "all areas of the Moon and other celestial bodies", without mentioning the question of access to outer space itself. Was it just an omission or a deliberate silence ?

6. See Carl Q. Christol, The Natural Resources of the Moon: The Management Issue, paper presented at the Forty-first Colloquium on the Law of Outer Space /Melbourne, 1998/.

7. See Resolution 2749 /XXV/ of 17 December 1970 in General Assembly Official Records: Twenty-fifth session, Supplement No. 28 /A/8028/, pp. 24-25.

8. See the text of the 1982 UN Convention in The Law of the Sea, Official Texts of the United Nations Convention on the Law of the Sea of 10 December 1982 and of the Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 with Index and Excerpts from the Final Act of the Third United Nations Conference on the Law of the Sea. United Nations, New York, 1997, pp. 21 ff.

9. See the text of the 1994 Agreement in the UN publication The Law of the Sea, mentioned supra in reference 8, pp. 214 ff.

10. See the Table showing the status of the Convention and of the Agreement relating to the implementation of Part XI of the Convention, as at 1 April 1998 in Law of the Sea Information Circular No. 7, March 1998, Division for Ocean Affairs and the Law of the Sea, Office of Legal Affairs, United Nations, New York, pp. 1-12.

11. See the text of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies in the UN publication United Nations Treaties and Principles on Outer Space, mentioned supra in reference 4, pp. 28 ff. As to the conflict of different approaches to the concept of Common Heritage of Mankind and its reflection in the Agreement, see V. S. Meni, The Common Heritage of Mankind: Implications for the Legal Status of Property Rights on the Moon and Celestial Bodies, Proceedings of the Thirty-ninth Colloquium on the Law of Outer Space /Beijing, 1996/, pp. 31 ff.

12. See the text of the Convention on the Regulation of Antarctic Mineral Resource Activities in Doc. AMR/SCM/88/78, June 1988. It is also reprinted in the monograph of Sir Arthur Watts, mentioned supra in reference 1, pp. 341 ff.

13. The term "development" in this Convention is alike to the term "exploitation" which is used in the 1982 UN Convention on the Law of the Sea, the 1979 Moon Agreement and in many other legal documents relating to mining activities. Its definition in the Wellington Convention reads as follows: "'Development' means activities, including logistic support, which take place following exploration and are aimed at or associated with exploitation of

specific mineral resource deposits, including pilot projects, processing, storage and transport activities."

14. As mentioned in the paper by Jonathan F. Galloway, Limits to Sovereignty: Antarctica, Outer Space and the Seabed, submitted to the Forty-first Colloquium on the Law of Outer Space /Melbourne, 1998/.

15. See e.g. Draft Regulations on Prospecting and Exploration for Polymetallic Nodules in the Area Proposed by the Legal and Technical Commission, Doc. ISBA/4/C/4/Rev. 1, 29 April 1998.

16. The International Lunar Workshop, which was convened by the ESA and held in Beatenberg /Interlaken/, Switzerland, 31 May - 3 June 1994, discussed a strategy for the exploration and utilization of the Moon in four successive phases to be accomplished in about 25 years. The beginning of the Moon-resource exploitation was envisaged only for a distant future. As explained by G. Girault from Toulouse, France in his report on Technical Thresholds between Robotic, Man-Tended and Permanently Manned Exploration and Exploitation of the Moon: "The lunar base will have to be expanded to a high structural complexity, including dedicated machinery not only for mineral exploitation, but also to monitor and maintain the base itself. This will require important energy resources and sophisticated levels of robotics. The increased complexity will be all the more important in the case of on-base work being carried out by humans." See International Lunar Workshop, ESA SP-1170, November 1994, p. 121.