

ASSOCIATION INTERNATIONALE DE GÉODÉSIE

BUREAU GRAVIMÉTRIQUE
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N° 20

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Mars 1969

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BUREAU GRAVIMÉTRIQUE

INTERNATIONAL

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COMMISSION GRAVIMETRIQUE INTERNATIONALE

Paris - 1970

La Commission Gravimétrique Internationale se réunira à Paris dans la première quinzaine de Septembre , entre le 31 Août et le 13 Septembre 1970.

Si cette date ne convient pas à certains Délégués, particulièrement intéressés par les travaux de la Commission, ils sont priés de le faire connaître, sans retard, au B.G.I.

Une circulaire détaillée sera envoyée à toutes les personnes intéressées avant la fin de l'année 1969 (fixant les dates exactes et un avant projet de l'ordre du jour).

The International Gravity Commission will be held in Paris during the first part of September, between August 31 and September 13, 1970.

If this date is not convenient to some Delegates, particularly interested in the Commission's works, they are kindly asked to send their suggestion to the International Gravity Bureau, without delay.

A detailed circular will be sent to every Delegate before the end of this year, giving the exact dates and a draft of the agenda.

Adresse du B.G.I. : BUREAU GRAVIMETRIQUE INTERNATIONAL

9, Quai Saint-Bernard, tour 14
(75) PARIS 5ème

Notices nécrologiques

Professeur Silvio BALLARIN

"Le 11 Mars 1969, Silvio Ballarin, Professeur de Topographie et Géodésie à l'Université de Pise, Membre effectif de "l'Accademia Nazionale dei Lincei" et Membre de la "Commissione Geodetica Italiana", est décédé à l'âge de 68 ans.

L'activité scientifique du Prof. Ballarin est retracée dans plus de 60 mémoires qui traitent d'un grand nombre de sujets, surtout d'astronomie géodésique, de méthodes d'interprétation des anomalies gravimétriques et de la gravimétrie en général. L'astronomie géodésique a été l'objet de ses premières études et même plus tard, il a continué à s'intéresser aux problèmes relatifs à la détermination des coordonnées géographiques, jusqu'en 1953.

Plusieurs de ses mémoires traitent de l'interprétation des anomalies gravimétriques, principalement dans le domaine des méthodes d'interprétation indirecte et dans celui du calcul des corrections topographiques.

Le domaine qu'il a étudié plus en détails, d'une façon magistrale, est celui des recherches sur la gravimétrie, soit du point de vue expérimental, soit pour les réductions et les calculs des anomalies.

Les mesures pendulaires exécutées par Ballarin révèlent toute son habileté d'expérimentateur ; elles sont, parmi les mesures effectuées avec les anciens appareils, considérées comme les meilleures.

Dans le domaine des calculs, Ballarin a contribué activement à la préparation des tables fondamentales de Cassinis et il a dirigé d'une manière admirable l'énorme masse de travaux nécessaires à la préparation des cartes gravimétriques d'Italie à l'échelle 1:10⁶. Pendant plus de dix ans il a consacré tout son temps et a apporté son concours scientifique à l'établissement des cartes. Actuellement, ces cartes sont terminées et seront publiées par la "Commissione Geodetica Italiana".

Le dernier travail auquel Ballarin s'est dévoué a été une étude sur les corrections topographiques et isostatiques des déviations de la verticale, et sur l'application des procédés envisagés par lui-même, aux mesures faites jusqu'à présent en Italie, au nord du parallèle de Gênes. Un volumineux mémoire sur cette étude est en cours de publication.

Les traits dominants de tous les travaux exécutés par le Prof. Ballarin sont une extrême rigueur et une sévère critique des données expérimentales, et de ce fait l'absolu bien fondé des résultats".

Prof. Orlando Vecchia.

Brigadier Martin HOTINE

Noted surveyor who helped map Commonwealth

"Brigadier Martin Hotine, C.M.G., C.B.E., who has died at the age of 70, was one of the outstanding surveyors of his generation.

He spent virtually the whole of his working life in the surveying and mapping field and had an international reputation as a mathematician, a surveyor and an administrator. He was head of the British Military Survey Service for the major part of the Second World War and after that was mainly responsible for the considerable surveying and mapping contributions to the underdeveloped countries of the British Commonwealth, which has formed a significant part of British technical assistance since the war. He travelled widely throughout the Commonwealth and was well known for his practical approach to all problems, his forthright speech and his keen sense of humour. Throughout his career he made a number of important contribution to the science of geodesy, and on retirement was engaged by the United States Government to work out in detail his theories on three-dimensional geodesy which has important applications to the study of satellites.

Martin Hotine was born in 1898 the son of F.M. Hotine. He was educated at Southend High School and after passing through Woolwich obtained a scholarship to Magdalene College, Cambridge. He was commissioned in the Royal Engineers in 1917 and saw service in Persia, Iraq and India. He was appointed Research Officer to the Air Survey Committee during 1925-28 and made substantial contributions to the techniques of mapping from air photographs. After three years at the War Office he was engaged in surveys of Malta and Gozo and of a section of the 30th arc of meridian in Central Africa, during which he made important changes in the procedures for observing geodetic triangulation and in the precise measurement of distance which at that time was done with invar steel tapes to accuracies of better than one part in a million. He was then posted to the Ordnance Survey and was responsible for initiating the procedures to be followed in the retriangulation of Great Britain, which continued on the same lines until its completion in 1962.

At the beginning of the war he was posted to France and after Dunkirk to east Africa and Greece but in 1941 he became Director of Military Surveys and continued in this post with the rank of brigadier

until 1946. During this period he not only reorganized the whole system of British military mapping production and distribution but also negotiated in 1942 a far-reaching agreement with the United States for the supply of maps, air photographs and survey services to the Allies in the different war theatres.

During his pre-war service in Africa Hotine became aware of the need for a central organization to carry out the long term geodetic and mapping requirements of the colony ; and he played a considerable part in the initial planning during the closing years of the war of what was formed in 1946 as the Directorate of Colonial Surveys, now the Directorate of Overseas Surveys in the Ministry of Overseas Development. He became the first Director and Survey Adviser to the Secretary of State for the Colonies and remained in this post until his retirement in 1963. The main effort of the directorate has been devoted to the production of one in 50.000 scale maps with 50ft. contours and thanks to Hotine's foresight this work continued in most of the colonies after independence. The total area mapped now approaches two million square miles.

He was Founder's Medallist of the Royal Geographical Society and was first recipient of the President's Medal of the Photogrammetric Society. In 1924 he married Kate Pearson. They had three daughters".

from : The Times, November 13, 1968.

Nous apprenons au dernier instant le décès du Professeur Paolo DORE, ancien Doyen de la Faculté des Sciences de Bologne, Président de la Commission Géodésique italienne et ancien Président de la Section II de l'Association Internationale de Géodésie. Le Prof. Dore s'était toujours intéressé aux problèmes de Gravimétrie. Il avait collaboré avec Gino Cassinis et Silvio Ballarin à l'établissement des tables fondamentales pour la réduction des valeurs observées de la pesanteur.

Les recherches gravimétriques et magnétiques
de la structure des Océans

par A.G. GAINANOV

"Utilisées avec d'autres méthodes de recherche, la gravimétrie et la magnétométrie donnent des informations précieuses sur la zonation de bassins marins. Elles ont réussi à mettre en évidence des fractures ayant différentes profondeurs, à déterminer l'épaisseur de la couverture sédimentaire, à prospecter des bombements importants, des dépressions, ainsi que l'existence de blocs isolés à l'intérieur de ces dernières, à classifier les corps magnétiques, à étudier la limite entre l'écorce terrestre et le manteau supérieur, les caractères physiques (densité, pression, régime thermique, etc...) de l'écorce et du manteau supérieur. Les recherches de géophysique et de géologie marines du dernier temps ont démontré que le plateau continental représente la région de plus grande perspective en ce qui concerne la prospection de matières premières (pétrole, gisements alluvionaux d'or, de diamants, etc...).

Dans la prospection de tels gisements, et particulièrement dans la prospection pétrolière sur les plateaux continentaux de mers internes et marginales, les mesures de la force de gravité sont faites jusqu'à la profondeur approximative de 200 m. à l'aide de gravimètres télécommandés. En U.R.S.S. quelques modifications ont été apportées aux gravimètres marins astatiques en quartz. En fonction de la densité du réseau d'observation et de la précision de la navigation (les coordonnées par des méthodes radiogéodésiques et les profondeurs par des échosondes) on peut réaliser des cartes d'anomalies gravimétriques avec une équidistance entre les isanomales de 0,5 à 2,0 mgal.

A l'aide de gravimètres posés sur le fond, on a levé les zones de faible profondeur du nord de la mer Caspienne (dans la région de la presqu'île d'Apchéron et de l'île de Tcheléken), de la mer d'Azov, de la mer Noire, du golfe de Riga, de la mer d'Okhotsk etc... Ces levés ont mis en évidence les zones de déformations tectoniques, ont précisé le relief et la structure de soubassement consolidé, ont montré l'existence de dômes de sel, ainsi que d'importantes structures branchi-anticlinales ou anticlinales dans la couverture sédimentaire. (1).

La prospection gravimétrique au large est effectuée à l'aide de gravimètres de surface ou d'appareils pendulaires. A présent, grâce à l'amélioration des gravimètres marins de surface, on peut faire des mesures continues de la gravité pendant le mouvement du bateau avec une précision de ± 2 à ± 10 mgal, suivant l'état de la mer, le tonnage du bateau, la constance de la vitesse de déplacement et la précision de la navigation. En U.R.S.S. existent plusieurs variantes de gravimètres marins amortis, en quartz. Une variante très intéressante parmi les gravimètres soviétiques de surface est le gravimètre amorti automatique, en quartz avec enregistrement continu de la variation de la gravité sur un enregistreur à potentiomètre. Les essais de cet appareil dans les longues missions effectuées sur le navire de recherches "Vityaz" dans les Océans Indien et Pacifique, ainsi que dans la mer du Japon ont démontré la sûreté des enregistrements même dans des conditions difficiles de travail et une exactitude de l'ordre de ± 5 mgal par une mer de force 2.

Pour l'interprétation géologique, on utilise en général les anomalies de gravité dans la réduction de Faye ou dans celle de Bouguer. L'application de la correction isostatique est utile dans des recherches régionales pour la mise en évidence des hétérogénéités profondes de densité.

A présent on peut dire que toutes les données géologiques et géophysiques confirment la structure stratifiée d'une part et en blocs d'autre part de la croûte terrestre et du manteau supérieur. L'image de la structure en blocs de l'écorce et du manteau supérieur nécessite une mise au point et une application de méthodes correspondantes d'interprétation quantitative des anomalies de la pesanteur. Les corps perturbateurs du champ de pesanteur sont comparés à des modèles représentant des gradins verticaux, des prismes rectangulaires ayant une longueur infinie ou à des parallélépipèdes rectangulaires. Pour l'interprétation quantitative des anomalies créées par de tels corps, on a construit des abaques bilogarithmiques, permettant de déterminer la profondeur des limites supérieures et inférieures ainsi que l'excès de masse $\Delta \pi$ du corps perturbateur ayant la forme d'un parallélépipède rectangulaire (2,3). La détermination des bordures inférieures nous donne une idée sur la position des limites profondes quasi-horizontales de l'écorce. Dans certains cas favorables, cette détermination permet de mettre en évidence la profondeur des fractures séparant les masses à densité différente. L'évaluation de la différence de densité entre divers blocs permet la construction des schémas illustrant les hétérogénéités profondes de densité d'une part, et leur interprétation pétrographique ultérieure d'autre part.

Les mesures du champ magnétique total, ayant comme but l'étude de la structure des fonds marins, sont effectuées avec des magnétomètres nucléaires, remorqués par un navire ou un avion à distance suffisante pour éliminer leur propre influence magnétique. En U.R.S.S. il existe quelques types de ces appareils. Pour séparer d'un champ magnétique total les valeurs anormales, provoquées par l'hétérogénéité de la lithosphère, il faut exclure de la valeur mesurée le champ magnétique normal. Jusqu'à présent le problème de l'élimination du champ magnétique normal, champ très compliqué et variable, n'est pas résolu. D'habitude on utilise pour des régions peu étendues un champ normal calculé comme une moyenne des valeurs mesurées ou approximatives à l'aide des polynômes du deuxième ou troisième ordre.

On peut diviser la prospection magnétique des bassins marins avec les magnétomètres remorqués en fonction des exigences envers les appareils et les méthodes de façon suivante :

1°) La prospection magnétique des vastes régions marines et océaniques de petite échelle. On exige alors : une précision des appareils de ± 3 à $\pm 5 \gamma$, la possibilité d'un travail de longue durée ininterrompu à n'importe quelle latitude. Une telle prospection est effectuée d'habitude par des navires géophysiques et hydrographiques en même temps que la mesure de la profondeur avec les écho-sondeurs, les mesures du champ de gravité et autres recherches océanographiques.

2°) La prospection magnétique détaillée des régions littorales.

La précision des mesures doit être équivalente à celle de la prospection magnétique terrestre. L'exigence de précision et de résolution des appareils est plus grande, de même que pour la précision de la navigation.

Dans une prospection magnétique on prend en considération les variations du champ terrestre. Le problème le plus important dans les variations géomagnétiques sur mer, est l'effet du littoral.

Les levés effectués sur les plate-formes continentales ont montré que, dans la plupart des cas, les anomalies magnétiques prolongent en mer des zones anormales terrestres. Ce fait est souligné par les directions et les caractères de zones absolument identiques sur terre et en mer. L'intensité des anomalies magnétiques dépend de la composition pétrographique du fond, de l'épaisseur de la couverture sédimentaire et de la structure du soubassement. Le champ magnétique de la plate-forme continentale donne l'impression en somme, d'une terminaison sous-marine du continent.

La transition de la plate-forme vers les zones profondes océaniques est accompagnée, dans la plupart des cas, d'un changement brusque de la structure du champ anormal géomagnétique. Sur la pente continentale on observe des anomalies positives tandis que la base de la pente se caractérise par des anomalies négatives.

Les anomalies positives, en majorité, ont des maximums isolés, disposés dans une zone allongée parallèle à la pente continentale. Ces maximums sont provoqués soit par des surélèvements dans la bordure continentale, soit par des fractures dans la région de contact entre le continent et l'océan. Les calculs de la profondeur de la limite supérieure des corps magnétiques montrent que la zone des anomalies négatives, correspondent probablement à une fosse structurale marginale. (4).

Sur les rides médio-océaniques on a mis en évidence des anomalies allongées qui changent alternativement de sens. L'amplitude des anomalies isolées atteint 1000 - 1300 γ . On essaie de déterminer la vitesse d'expansion du fond océanique en prenant en considération la distance entre les secteurs de sens contraire (la largeur des zones de signe inverse) - (5,6).

Ces dernières années ont été faites des mesures magnétiques sur des montagnes sous-marines. Comme règle générale, les montagnes sous-marines sont rattachées aux systèmes des crêtes océaniques, aux arcs insulaires ou aux fractures régionales. Dans des cas particuliers elles représentent des reliefs isolés. Les chercheurs soviétiques ont essayé de classifier les montagnes sous-marines d'après les caractères du champ magnétique en simples et complexes (7). Les montagnes simples présentent des anomalies se rapprochant des anomalies théoriques, calculées pour une source aimantée d'une façon homogène. D'habitude ces anomalies sont isométriques et bien localisées. Pour les anomalies complexes la construction d'un modèle théorique en choisissant la direction et l'intensité d'une aimantation homogène, ainsi que les dimensions et les formes du corps, est pratiquement impossible. Le degré de la complexité d'une anomalie permet de juger de la génèse de la montagne.

On sait que l'intensité de l'aimantation des volcans actuels andésitiques ne dépasse pas en général 0,008 - 0,01 cgs M, celle des volcans basaltiques varie de 0,02 - 0,05 cgs M.

L'analyse des données existantes à l'heure actuelle sur les montagnes sous-marines montre que ces montagnes peuvent être :

1°) Représentées par des volcans (Madère, Météor, dans l'océan Atlantique, la majorité des montagnes sous-marines du golfe de Californie dans l'océan Pacifique, etc...)

2°) Des volcans recouverts (Bermudes, les bancs calcaires de Kampeche et de Floride dans l'Atlantique, l'atoll Enivetok dans le Pacifique, etc...).

3°) Des îles qui perçoivent le fond marin (Svolloy-Banc dans l'océan Atlantique).

4°) Des intrusions de roches peu magnétiques dans la couche basaltique du fond océanique (Patton dans le Pacifique, etc...).

5°) Des roches éruptives recouvertes (Explorer-Banc dans la mer des Caraïbes).

Les montagnes sous-marines non magnétiques sont beaucoup plus rares. Les blocs tectoniques séparés du continent par des failles (Vigo, Oporto, Galicée), ainsi que les montagnes d'une constitution inconnue, qui se trouvent dans le large parmi les volcans font partie de cette catégorie.

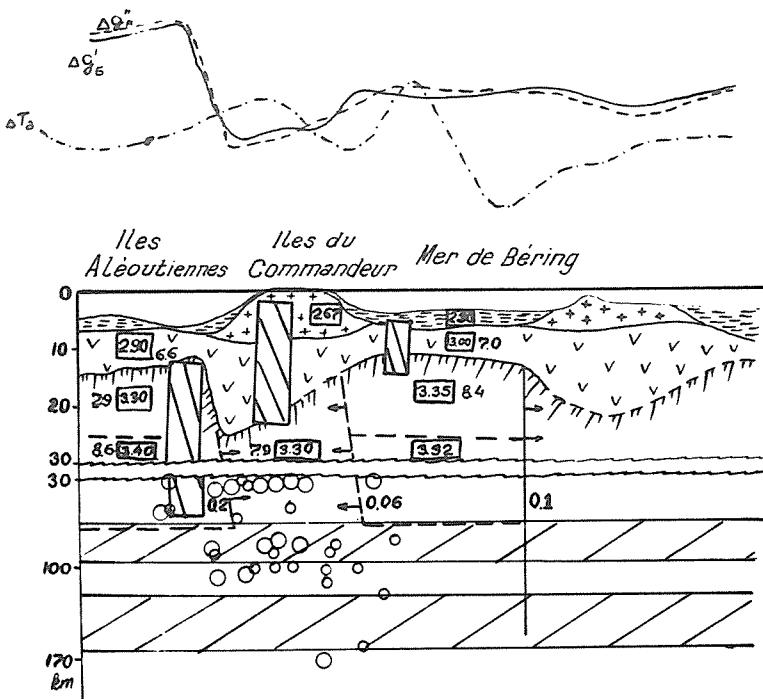
Les bassins marins les plus étudiés sont ceux de l'Extrême-Orient (mer de Bering, mer d'Okhotsk, mer du Japon). On a trouvé ici de grandes anomalies du champ magnétique et de pesanteur (8,9). L'interprétation des anomalies de gravité avec les corrections de Faye, de Bouguer et isostatiques, des anomalies magnétiques et d'autres données géologiques et géophysiques, a permis de préciser la structure tectonique de ces bassins et de tracer, en lignes générales, la structure profonde de l'écorce et du manteau supérieur de la zone entre le continent Asiatique et l'océan Pacifique (2,3,10). On a mis en évidence la structure en blocs et couches concentriques de l'écorce et du manteau supérieur et les particularités dans la disposition des fractures et des excès de masse à l'intérieur de ceux-ci (fig. 1a, b et c).

1°) La profondeur des fractures dans les zones de transition, des arcs insulaires, augmente vers le continent, tandis que le degré de la différenciation par densité de blocs augmente vers l'océan.

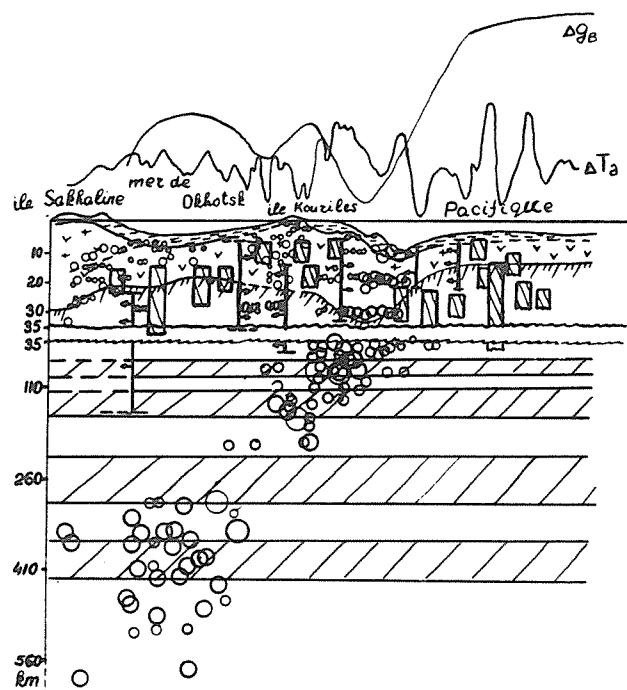
2°) Beaucoup de fractures ne percent pas la limite de densité entre l'écorce et le manteau supérieur.

3°) Les limites supérieure et inférieure des hétérogénéités de densité (donc les profondeurs de pénétration en haut et en bas des fractures les séparent) tendent vers certains niveaux. A des profondeurs accessibles à l'investigation de la sismique profonde, ces niveaux sont représentés par les discontinuités Mohorovicic, Conrad, etc... L'analyse statistique des mesures du champ de pesanteur permet de penser que de telles discontinuités existent dans le manteau supérieur de la

FRACTURES DE L'ECORCE TERRESTRE ET DU MANTEAU SUPERIEUR



* Fig. 1a : Iles Aléoutiennes – Ile du Commandeur – Mer de Bering.



* Fig. 1b : Ile Sakhaline – Mer d'Okhotsk – Iles Kouriles – Océan Pacifique.

* Voir légende page suivante.

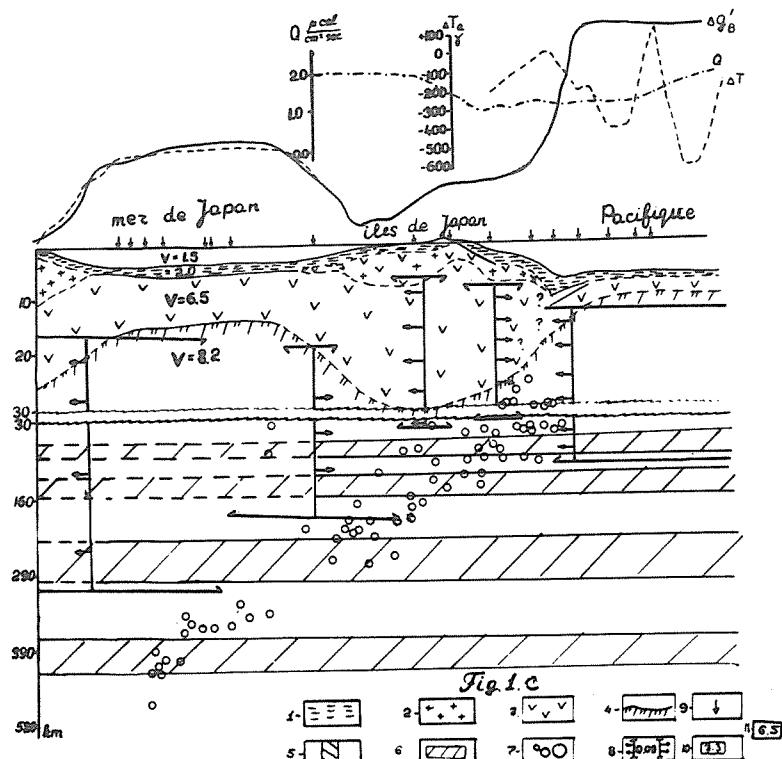


Fig. 1c : Mer du Japon – îles du Japon – Océan Pacifique.

Légende des Figures 1a, 1b, 1c.

- 1 – Couches sédimentaires
- 2 – Couche "granitique"
- 3 – Couche "basaltique"
- 4 – Discontinuité de Mohorovic
- 5 – Corps perturbateur du champ magnétique
(les dimensions transversales ne sont pas à l'échelle)
- 6 – Asthénocouche (de faible vitesse)
- 7 – Foyers des séismes
- 8 – Fractures d'après les données gravimétriques
(les flèches montrent le sens de diminution de la densité)
- 9 – Points sismiques
- 10 – Densité en gr/cm^3
- 11 – Vitesses des ondes longitudinales en km/sec .

zone de passage du continent Asiatique à l'océan Pacifique, à des profondeurs de 50-60 km, de 120-140 km, de 190-220 et peut-être de 300-400 km.

La coïncidence de ces profondeurs avec les quatre asthénocouches déterminées par des recherches sismiques est très intéressante. On peut dire que entre les blocs de faible densité du manteau supérieur, les forts gradients du flux thermique, la réduction de la profondeur de la limite inférieure des corps perturbateurs du champ magnétique, les types pétro-chimiques des roches volcaniques se précise une corrélation. On remarque la tendance des hypocentres de séismes localisés dans le manteau à s'approcher de la limite inférieure des blocs ayant une densité différente.

L'analyse des anomalies isostatiques a permis de mettre en évidence l'existence dans les mers de l'Extrême Orient des régions presque équilibrées, sur et sub-compensées. L'écart le plus grand par rapport à l'équilibre isostatique se trouve dans la région des arcs insulaires d'Aléoutiennes et Kourilles-Kamtchatka. Ce fait indique que la lithosphère en cette région se trouve dans un état de tension remarquable, ce qui est d'ailleurs confirmé par une grande activité sismique et volcanique. Par les anomalies isostatiques de la fosse Komodore (mer de Bering) on peut suivre un prolongement plus ancien de l'arc des îles Kourilles et de Kamtchatka actuel qui sont déplacés l'un par rapport à l'autre de 150 - 200 km.

Dans les mers de Bering, d'Okhotsk et du Japon ont été mis en évidence des blocs, limités par des failles de diverse profondeur ; on a précisé les limites de dépressions et de surélèvements, ainsi que la direction des systèmes plissés d'âge différent (fig. 2, page suivante)".

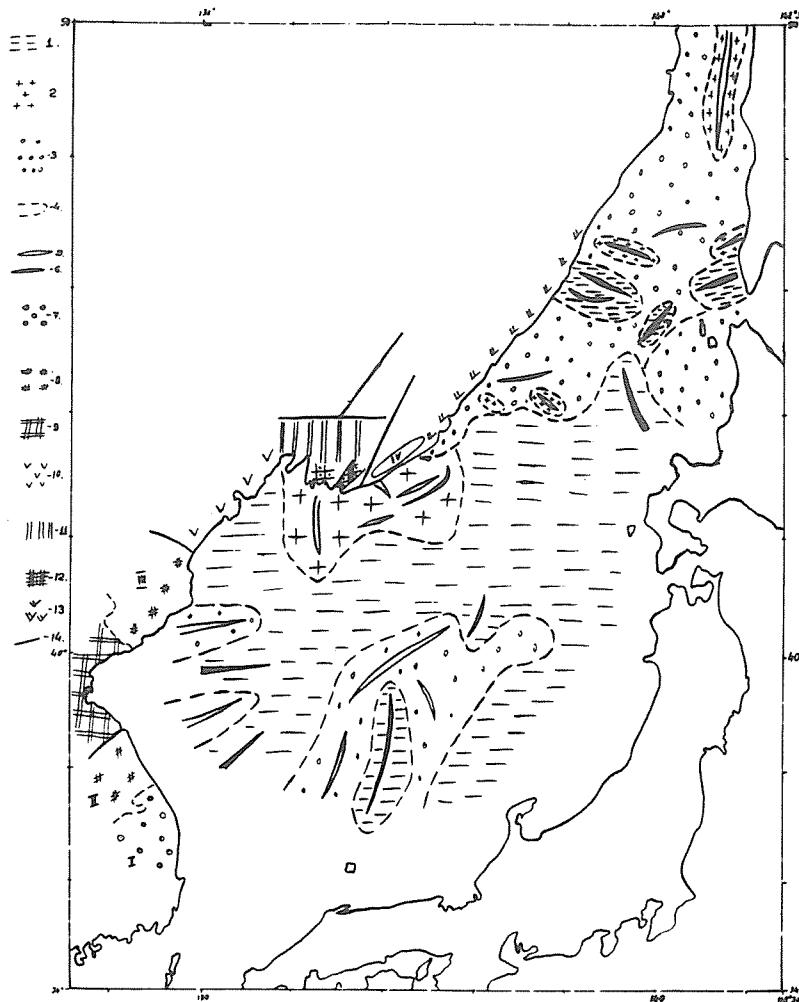


Fig. 2 : Schéma de la structure profonde de la mer du Japon.

- 1 — Régions aux fortes anomalies isostatiques
- 2 — Régions à faibles anomalies isostatiques
- 3 — Régions aux anomalies isostatiques proches de zéro
- 4 — Limites des blocs de l'écorce terrestre
- 5 — Axes de minimums isostatiques
- 6 — Axes de maximums isostatiques
- 7 — Fosses de type Pacifique superposées
- 8 — Soubassement plissé des anciennes plateformes sous la couverture sédimentaire
- 9 — Saillies du soubassement plissé des anciennes plateformes
- 10 — Régions de plissement hercienien
- 11 — Complexe plissé géosynclinal
- 12 — Saillies du soubassement constituées par des roches protérozoïques et paléozoïques
- 13 — Roches magnétiques pré-tertiaires
- 14 — Fractures en profondeur

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 - 8) GAINANOV A.G. - "Quelques résultats de recherches gravimétriques dans la mer d'Okhotsk, dans la fosse Kourillo-Kamtchatkienne et dans les régions voisines de l'océan Pacifique". Morskies, Gravimetritcheski issledovania, t.2, Ed. MGU, 1963.
 - 9) SOLOVIEV O.N. & A.G. GAINANOV. - "Les particularités de la structure géologique de la zone de passage du continent Asiatique vers l'océan Pacifique dans la région de l'arc des îles Kourilles et de Kamtchatka". Sovetskaia Geologia, t.3, 1963.
 - 10) GAINANOV A.G. - "La structure de l'écorce terrestre et du manteau supérieur dans les régions de passage entre continents et océans". Vestnik MGU, Sér. Géol., t.3, 1968.
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MESURES de PESANTEUR en MER

Informations diverses

1°) ETATS-UNIS : WOODS HOLE OCEANOGRAPHIC INSTITUTION (W.H.O.I.)

- Program MEDOC 69 - ATLANTIS II

a) "The Atlantis II will depart from Woods Hole on January 6 for a six and one-half month cruise in the Mediterranean and Black Sea on a program titled MEDOC 69 (Mediterranean Oceanography).

The Mediterranean influences the waters of the North Atlantic, and the formation of this dense water mass is of great interest to the scientists of many countries. The cruise plan calls for the participation of five ships : HMS Hydra and Discovery from the United Kingdom, the Jean Charcot and Origny from France, and R/V Atlantis II. Joining these ships will be the Institution's C-54Q and an Italian ship Dectra.

Scientists participating in the cruise will come from several institutions and nations including the Massachusetts Institute of Technology ; National Institute of Oceanography, England ; the University of Southampton, England ; Laboratoire d'Océanographie Physique, France ; Scripps Institution of Oceanography, and some German scientists. While cruising the eastern section of the Mediterranean, scientists from other nations will be invited to take part".

Newsletter, W.H.O.I.,
v.10, n°1, Jan. 1969.

b) "The gravity measurements in the Black Sea during our recent cruise of the Atlantis II have been successful. These measurements were conducted with the prototype vibrating string gravity meter developed by Dr. Charles Wing of Massachusetts Institute of Technology. Except for two days or record which were lost because of improper thermostatic control of the acclerometer oven owing to interference from the ship's radio, measurements were obtained during the entire five weeks of investigation in Black Sea".

C. Bowin, May 1969.

- Reports on the gravity measurements

c) The first of a series of reports containing the gravity measurements obtained by the W.H.O.I. has just been published :

"Gravity data obtained during Chain cruise # 70"

by C. Bowin & T.C. Aldrich, Ref. n°69-6 (Unpublished manuscrit).

d) "This report presents the results of gravity measurements obtained in the Western North Atlantic Ocean, aboard the Research Vessel Chain of the W.H.O.I. during cruise number 70, 12 July to 2 August, 1967. Information on bathymetry and other studies conducted during Chain cruise 70 may be found in W.H.O.I., Ref. n°68-50.

The gravity measurements were made with LaCoste & Romberg gimbal-mounted sea gravity meter number 3-13. The base station used for the measurements is at the W.H.O.I. dock in Woods Hole, Massachusetts, and a base gravity value of 980.0327.0 mgal was used in the reduction of the measurements. More recent ties of this base station with stations in the Boston, Massachusetts area that are part of the national network (anonymous, 1965) indicate that the adopted value is high by about 1.4 mgal. Drift of the S-13 gravity meter during Chain 70 was - 0.118 mgal/day from in-port measurements at beginning and end of cruise. This drift value is anomalous in sign and magnitude with respect to the meter's over-all drift rate, and was not applied. The accuracy of the sea measurements is estimated to be about \pm 10 mgal (Bowin, Wing, and Aldrich, in press).

The data presented in this report consists of profiles, listings, and charts.

Principal facts, and free-air and Bouguer gravity anomalies are tabulated for all the gravity measurements. These listings provide the basic data for detailed use.

Three Mercator charts are included :

- 1 - time and date,
- 2 - free-air anomaly values, and
- 3 - Bouguer anomaly values.

The charts provide location information in a form helpful for examining the distribution of the gravity anomalies. The day, month, and year (in that order) are identified on the chart for the first data point of each new day. The time-annotated chart provides easy cross reference of the chart information to the data listings and profile plots.

A magnetic tape reel containing the gravity data for Chain cruise 70 is available, on loan, for duplication purposes, to interested parties who have need of the information in a computer compatible format. The data is recorded on 1/2 inch I.B.M. compatible (N.R.Z.I.) 7 track magnetic tape at 200 bpi".

2°) FRANCE : CENTRE NATIONAL pour l'EXPLOITATION des OCEANS (C.N.E.X.O.)

"Le gravimètre marin Askania G SS2 n°15 a été utilisé par le Service Hydrographique de la Marine à partir de 1963. Initialement monté sur "l'Amiral Mouchez", il fut transféré en 1964 à bord du "Paul Goffeny" et utilisé jusqu'en novembre 1967 où il fut stocké à l'Arsenal de Cherbourg.

Depuis janvier 1969, le gravimètre marin Askania G SS2 n°15 est installé à bord du "Jean Charcot". Après avoir testé le bon fonctionnement de l'appareillage, la première traversée (CH01) s'est déroulée de Brest à Toulon du 24 au 29 janvier 1969. Les prochaines campagnes où le gravimètre sera en fonction sont :

- "Gestlante III" du 23 mai au 4 juin dans le golfe de Gascogne.
- "Noratlante" du 1er août au 31 octobre 1969, sur le plateau continental français et britannique, dans la mer du Labrador, sur la crête médio-atlantique, et dans le golfe de Gascogne".

SERVICE HYDROGRAPHIQUE DE LA MARINE

- "Rapport sur l'étude du gravimètre marin Askania G SS2 n°15" Mai 1967. (95 pages + nombreuses planches).

Rapport détaillé rassemblant les études et observations de 1963 à 1965.

- "Le champ de pesanteur - Mesures en mer et applications" 1968. (35 pages).

A. Comolet-Tirman

3°) JAPON

Parmi les nombreux rapports qui viennent d'être adressés au B.G.I. on peut signaler en particulier :

"Measurement of gravity and magnetic field on board a cruising vessel", by Y. TOMODA, K. OZAWA & J. SEGAWA.

Contents

- Chapter 1 : The ship-borne gravity meter...
 - 1.2 - Development of the ship-borne gravity meter
 - . Bifilar gravity pendulum n°1,
 - . Bifilar gravity pendulum n°2,
 - . The Tokyo surface ship gravity meter T.S.S.G.
 - . Results of the T.S.S.G.- 60, 61 series gravity meters.
 - Negative Bouguer anomaly zone near the Japan island arc and the island arcs.
 - 1.3 - The T.S.S.G.- 63-1, 63-2 and 64 series gravity meters.
 - . Outline of the T.S.S.G.- 63-1, 63-2 and 64 series.
 - . Problems in installing the T.S.S.G. type gravity meter on board ship.
 - . Gravity computation.
- Chapter 2 : The ship-borne proton magnetometer
 - 2.1 - Development of the proton magnetometer in 1963-65
 - ...
- Chapter 3 : Gravity measurements in the Indian Ocean Expedition of the Umitaka-maru in 1963-1964. *
- Chapter 4 : Gravity measurements in the Southern Sea Expedition of the Umitaka-maru in 1964-1965. *
- Chapter 5 : Free air anomaly and achievement of isostasy.
- Chapter 6 : The T.S.S.G. as a ship-borne wave recorder.
- Chapter 7 : Magnetic anomaly at sea.
- Chapter 8 : Relation of the magnetic anomaly to the bottom topography, and estimation of the depth of the origin.
- Chapter 9 : Lineations in magnetic anomalies and their relation to the lineations in the bottom topography.
- Chapter 10 : Schematic view of the relation between the Bouguer gravity anomaly, the local magnetic anomaly and the bottom topography.

from : Bull. Ocean Res. Inst., Univ. Tokyo
n°3, September 1968.

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Position index maps of the Expeditions 1963..65 have already been published in "Bulletin d'Information" n°16, p. II - 6..

TRAVAUX en ARGENTINE

DETERMINATION de la PESANTEUR au SOMMET
de la MONTAGNE "ACONCAGUA" (6.959,6 m.)

Prof. E.E. BAGLIETTO

"La Chaire de Géodésie et l'Institut de Géodésie de la Faculté d'Ingénieurs de l'Université de Buenos Aires, devant l'évolution des instruments gravimétriques, depuis l'année 1935, ont eu le souci de s'équiper de gravimètres statiques dans des buts géodésiques et géophysiques.

Pendant l'année 1942, nous avons acheté le premier gravimètre, un "Mott Smith" et plus tard des "Worden", un gravimètre télécommandé "North American" et dernièrement des appareils "LaCoste & Romberg".

Ainsi, nous avons pu établir un réseau gravimétrique depuis la chaîne des Andes, dans la province de Mendoza (République Argentine) jusqu'à l'extrémité du fleuve Rio de la Plata, la plate-forme sous-marine de l'Atlantique et la frontière nord de la partie sud du pays ; et nous avons établi des liaisons internationales en collaboration avec la France, l'Angleterre, l'Italie et le Chili. (Bibliographie 4).

Dans la zone montagneuse de nos recherches, dans la province de Mendoza, les lignes de pesanteur vont du point fondamental de gravité du pays, (cave du Service de l'Heure à Migueletes, San Martin, province de Buenos Aires) jusqu'au point de la Plaza de Mulas, à 4.250 m. au-dessus du niveau de la mer, face à l'imposante montagne "Aconcagua".

Pendant la 32ème campagne géodésique de Janvier 1969, pour le cours de première année de l'Ecole de formation d'ingénieurs géodésiens, géophysiciens et hydrographes de l'Institut de Géodésie, Mr. P. Skvarca, andiniste renommé, a fait la tentative de mesurer la pesanteur au sommet de la montagne Aconcagua.

Son altitude de 6.959,6 ± 1,20 m. avait été calculée par l'Institut de Géodésie pendant sa 20ème campagne géodésique en Janvier 1956 par des méthodes géodésiques, dépassant de 74 m. la montagne "Ojos del Salado" qui avait été mesurée elle aussi par des méthodes géodésiques à la même époque du côté chilien par le Professeur de l'Université de Harvard - A. Carter. (Bibliographie 1 et 2).

Une équipe formée de Mr. Skvarca, Carranza et le Père B. de Filippis avec la collaboration de la Compagnie de Skieurs de haute montagne, lieutenant Ibanez de Puente del Inca, a rempli avec succès sa mission.

Résultats

Station	Altitude m.	Gravité mgal	Différence mgal
Ancienne "Plaza de Mulas"	4.015,71	978.463,4	
Neuve "Plaza de Mulas"	4.250 (1)	978.395,0	- 68,4
Refuge Berlin	6.100 (1)	978.041,3	-353,7
Sommet Aconcagua	6.959,60	977.726,0	-315,3

Référence : Repère n°1 Uspallata, $g = 978.911,20$ mgal.

(1) Altitudes approximatives.

En tenant compte de la différence d'altitude entre l'ancienne "Plaza de Mulas" et le sommet de la montagne Aconcagua, on obtient un gradient moyen de l'ordre de 0,251 mgal par mètre, ce qui permet d'avoir une idée de l'état isostatique de l'écorce terrestre.

Dans la prochaine campagne en Janvier 1970, on multipliera le nombre de stations de gravité jusqu'à 6.500 m. d'altitude, pour faire une étude plus approfondie des caractéristiques du champ gravimétrique terrestre à cette altitude.

Pour l'Hémisphère Occidental, la station au sommet de la montagne Aconcagua est le point le plus haut où a été déterminée la valeur de la gravité. Pour l'Hémisphère Oriental, dans la région du Mont Everest, ont déjà été établis des profils gravimétriques avec une altitude maximum de 22.000 pieds ou 6.949,4 m., c'est-à-dire 10,2 m. de moins que l'altitude de la montagne Aconcagua. (Voir : "American on Everest" by James R. Ullman, chapitre 16 intitulé "Geology and Glaciology" by Waynard Miller)".

Bibliographie

- 1 - Memoria de los Trabajos, Experiencias e Investigaciones, Reunion Cuba año 1958 del I.P.G.H. y Consulta sobre Cartografia por el Instituto de Geodesia de la Fac. Ing., Buenos Aires.
- 2 - Idem - Asamblea de Toronto de la U.G.G.I., 1957.
- 3 - Geographical Review n°2, año 1957. A. CARTER.
- 4 - Memoria de los Trabajos, Experiencias e Investigaciones, Reunion de Washington año 1969 del I.P.G.H. y Consulta sobre Cartografia por el Instituto de Geodesia de la Fac. Ing., Buenos Aires.

A superconducting gravimeter

W.A. PROTHERO, Jr & J.M. GOODKIND

Summary

"A gravimeter is constructed which uses the near perfect stability of superconducting persistent currents to make it a device with exceptional stability. A superconducting sphere is levitated in the magnetic field generated by two superconducting coils. Changes in gravitational or inertial forces in the vertical direction are measured as changes in the vertical position of the sphere or as changes in a feedback force, independent of the primary supporting force, which holds the sphere in a fixed position. In its present state of development the instrument produces data which, when compared to calculated earth tides, set an upper limit on the drift rate of ± 6 parts in 10⁹ of g/day. Several possible sources of drift are discussed.

Introduction

A gravimeter with potentially very low noise and drift rate operating in liquid helium at 4.2 K and utilizing the phenomenon of superconductivity is described in this paper. The noise level has been measured and a comparison with the calculated earth tides is presented.

The principle of operation of the device is much the same as conventional gravimeters where a mass is suspended on a spring and its position measured electronically. In this device the mass and spring are in the form of a superconducting magnet and superconducting ball. The superconducting magnet is operated in the persistent mode so that a very stable field may be obtained. The position of the ball is measured by both capacitive and magnetic sensors...

Results of operation

The gravimeter is now being operated in the basement of the UCSD Physics-Chemistry building in a Dewar which requires filling every eight days. It is supported by a concrete block disconnected from the floor and resting on the dirt below...

... A comparison of the superconducting gravimeter to the best conventional gravimeters may be made. In the frequency range between 5 and 15 cycles/h, a particular modified LaCoste gravimeter has rms instrumental noise of 3×10^{-11} g during seismically quiet periods. The observed 3×10^{-9} g noise is 100 times worse than this. It is not presently known what fraction of this is physical noise generated in the building rather than instrumental. In the near future the correlation between signals obtained from this instrument and from a LaCoste gravimeter placed on the same pier will be measured. The comparison in the extremely low frequency region is very favorable. Typical LaCoste gravimeters drift 10^{-8} g/day and the present 6×10^{-9} g/day upper limit set for the superconducting gravimeter indicates its initial success. Elimination of the anomalous temperature coefficient should enable this figure to be considerably improved"...

from : The review of scientific instruments
v.39, n°9, September 1968.

LISTE des PUBLICATIONS
reçues au
BUREAU GRAVIMETRIQUE INTERNATIONAL
(Oct. 1968 - Mai 1969)*

CONCERNANT LES QUESTIONS DE PESANTEUR

* Etant donné le retard apporté à la parution de ce Bulletin, les publications reçues jusqu'en Mai 1969 ont été incluses.

LISTE DES PUBLICATIONS

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- 172 - KOCH K.R. - "Solution of the geodetic boundary value problem in case of a reference ellipsoid".
AFCRL-68-0158, Dept. Geod. Sci., Rep. n°104, Sci. Rep. n°20,
34 p, Columbus, 1968.

"The solution of the boundary-value problem of physical geodesy in the case of a reference ellipsoid is given with a relative error of the order of the square of the flattening of the Earth. The solution is obtained by representing the disturbing potential at the Earth's surface as the potential of a simple layer and by introducing this expression into the boundary condition. If the Earth's topography is neglected in the derived solution, a new solution of Stokes' problem for a reference ellipsoid is obtained. As an example, the geodetic boundary-value problem is solved for a mathematical model of the Earth".

- 173 - MORITZ H. - "On the use of the terrain correction in solving Molodensky's problem".
AFCRL-68-0298, Dept. Geod. Sci., Rep. n°108, Sci. Rep. n°21,
46 p, Columbus, 1968.

"An approximate solution of Molodensky's boundary-value problem, provided by adding the terrain correction to the free-air anomaly and using this modified anomaly in Stokes' and Vening Meinesz' formulas, admits of a physical interpretation in terms of Helmert's condensation reduction. The detailed investigation of this topic gives an insight into the interrelation between Molodensky's theory and the conventional method of gravity reduction and into the nature of the linear correlation of the free-air anomalies with elevation. By-products of the investigation are :
 - that the usual Bouguer reduction of gravity does not give Bouguer anomalies in the strict sense, and,
 - that a certain approximation, which is usually applied in practical solutions of Molodensky's problem, may lead into difficulties with respect to the deflection of the vertical".

^{*}

La numérotation n'est pas suivie car les publications ne se rapportant pas aux questions de pesanteur n'ont pas été indiquées.

- 176 - ZOMORRODIAN H. - "Kritischer Vergleich einiger Methoden zur Bestimmung der Lotkrümmung".
D.G.K., Reihe C, Dissert., H.n°118, 76 S, München, 1968.
- 178 - REISER R. - "Geodätische Ingenieurmessungen beim Bau der ersten deutschen Nachrichtensatellitenantenne in Raisting".
D.G.K., Reihe C, Dissert., H.n°120, München, 1968.
- 180 - SCHNEIDER M. - "Ergebnisse der Lotschwankungswemmungen mit Horizontal und Vertikalpendeln in Freiberg von 1963 bis 1966".
Geod. & Geophys. Veröff., Reihe III, H. n°10, 23 S, Berlin, 1968.
- 183 - BACKUS G. & F. GILBERT. - "The resolving power of gross Earth data".
Geophys. J. R. Astr. Soc., v.16, n°2, p.169-205, 1968.
"A gross Earth datum is a single measurable number describing some property of the whole Earth, such as mass, moment of inertia, or the frequency of oscillation of some identified elastic-gravitational normal mode. We show how to determine whether a given finite set of gross Earth data can be used to specify an Earth structure uniquely except for fine-scale detail, and how to determine the shortest length scale which the given data can resolve at any particular depth. We apply the general theory to the linear problem of finding the depth-variation of a frequency independent local Q from the observed quality factors Q of a finite number of normal modes. We also apply the theory to the non-linear problem of finding density vs depth from the total mass, moment, and normal-mode frequencies, in case the impressional and shear velocities are known".
- 184 - Association Internationale de Géodésie, Bull. Geod. n°89, 1968.
a) VEIS G. - "The determination of the radius of the Earth and other geodetic parameters as derived from optical satellite data".
p.253-276.
- b) DOBACZEWSKA W. - "Compte-rendu de la réunion de la sous-commission de la géodésie satellitaire pour l'Europe de l'Est".
p.309-314.

- c) YEREMEYEV V.F. & M.I. YURKINA. - "On the grade measurements".
p.315-324.
- d) YEREMEYEV V.F. & M.I. YURKINA. - "Evaluation of non-linear terms in Molodensky's integral equation for disturbing potential".
p.325-332.
- e) PELLINEN L.P. - "Comparison of different methods for computing the plumbline deflections in the mountainous areas".
p.345-354.
- f) KOZAI Y. - "Love's number of the Earth from satellite observations".
p.355-358.

"From periodic variations of the orbital inclinations of three artificial satellites 1959 Alpha 1, 1960 Iota 2, and 1962 Beta Mu 1 Love's number of the Earth and time lag of the bodily tide due to the friction are determined, respectively, 0.29 ± 0.03 and (10 ± 5) minutes in time.

While the previous paper on the determination of Love's number of the Earth (Kozai, 1967) was in press, a minor error was discovered in the Differential Orbit improvement program (DOI) of the Smithsonian Astrophysical Observatory (SAO). Since the analysis was based on time-variations of the orbital inclinations which were derived by the DOI from precisely reduced Baker - Nunn observations, it is likely that the results in the previous paper was affected by the error in the DOI. Therefore, the analysis is iterated by using the revised DOI. Three satellites, 1959 Alpha 1 (Vanguard 2), 1960 Iota 2 (rocket of Echo 1), and 1962 Beta Mu 1 (Anna) are adopted for determining Love's number in the present paper. The satellite, 1959 Eta, which was used in the previous paper, is not adopted here, since the inclination of this satellite shows irregular variations unexplained instead of 1959 Eta 1962 Beta Mu 1 is adopted as orbital elements from precisely reduced Baker - Nunn observations have become available for a long interval of time for this satellite".

- Cartes d'anomalies de Bouguer du BUREAU de RECHERCHES GEOLOGIQUES et MINIERES. 1968.
Echelle 1/80.000°
- Epinal n°85, densité 2,3
- Epinal n°85, densité 2,7

- Bouguer anomalies maps established by the COMMONWEALTH of AUSTRALIA, BUREAU of MINERAL RESOURCES, GEOLOGY & GEOPHYSICS.
Scale 1/500.000°, 1967.

- Green Swamp Well,	E. 53/B2-13 (R)
- Barrow Creek,	F. 53/B2-6 (R)
- Tanami East,	E. 52/B2-16 (R)
- Camooweal, Qld,	E. 54/B2-13 (R)
- Brunette Downs,	E. 53/B2-11 (R)
- Tennant Creek,	E. 53/B2-14 (R)
- Calvert Hills,	E. 53/B2-8 (R)
- Mount Isa, Qld,	F. 54/B2-1 (R)
- Bonney Well,	F. 53/B2-2 (R)
- Ranken,	E. 53/B2-16 (R)
- Beetaloo	E. 53/B2-6 (R)
- Newcastle Waters,	E. 53/B2-5 (R)
- Winnecke Creek	E. 52/B2-12 (R)
- Alroy,	E. 53/B2-15 (R)
- Mount Drummond	E. 53/B2-12 (R)
- Frew River,	F. 53/B2-3 (R)
- Wallhallow,	E. 53/B2-7 (R)
- South Lake Woods,	E. 53/B2-9 (R)
- Avon Downs,	F. 53/B2-4 (R)
- Helen Springs,	E. 53/B2-10 (R)
- Lander River,	F. 53/B2-1 (R)

- Bouguer anomalies maps established by the NORGES GEOGRAFISKE OPPMALING, Oslo (Norway).
- Egersund area, scale 1/100.000°, density 2,65, 1968.
- North Norway , scale 1/1.000.000°, density 2,65, 1968.

185 - COMOLET-TIRMAN A. - "Le champ de pesanteur - mesures en mer et applications".
Inst. Océan., Serv. Hydro, Marine,
Cours d'Océan. Phys., 35 p, Paris, 1968.

186 - BULLEN K.E. - "Empirical equations of state for the Earth's lower mantle and core".
Geophys. J., R. Astr. Soc., v.16, n°3, p.235-238, 1968.

"A quadratic representation of the incompressibility k in terms of the pressure p for the materials of the Earth inside the pressure range $0.4 < p < 3.2 \times 10^{12} \text{ dyn/cm}^2$ was empirically derived some years ago on the basis of seismic and other evidence. The numerical coefficients in the representation have been revised in the present paper, taking account of recent observational evidence. The revised quadratic law applies to the whole Earth below 1.000 km. The new evidence includes the recently revised estimate of the Earth's moment of inertia, revised seismic evidence on the lower core, and data from free Earth oscillations. The quadratic model is compared with linear models derived for the lower mantle and core separately. Attention is drawn to errors made when any of these models is applied at pressures less than $0.4 \times 10^{12} \text{ dyn/cm}^2$. It is pointed out that unqualified application of Birch's finite-strain formulae leads to some results for the Earth's deeper interior that are somewhat discordant with the empirical evidence here used".

187 - Geophys. J., R. Astr. Soc., v.16, n°4, 1968.

- a) DAHLEN F.A. - "The normal modes of a rotating, elliptical Earth".
p.329-367.

"It is possible to calculate precisely the theoretical eigenfrequencies of any Earth model which is non-rotating, spherically symmetric, and which has an isotropic static stress field and an isotropic dynamic stress-strain relation. In this paper Rayleigh's principle is used to provide a formalism which allows the approximate computation of the normal mode eigen-frequencies of any Earth model which is slowly rotating and slightly aspherical and anisotropic. This formalism is used to compute, correct to second order, the effects of the Earth's angular rotation, and correct to first order, the effects of the Earth's ellipticity of figure on the normal mode eigenfrequencies. It is found that for an arbitrary poloidal or toroidal multiplet, the central ($m = 0$) member of the multiplet is shifted slightly in frequency and that the other members of the multiplet are split apart asymmetrically by the effects of the Earth's rotation and ellipticity. The results may be used to make a preliminary correction for rotation and ellipticity to the Earth's raw normal mode data".

- b) ARI BEN MENAHEM & SARVA JIT SINGH. - "Eigenvector expansions of Green's dyads with applications to geophysical theory".
p.417-452.

"The treatment of boundary value problems in various vector-separable regimes is unified and facilitated with the use of the eigenvector expansion of their corresponding Green's tensors. In particular, the method is useful for the vector Laplace, Poisson, Helmholtz and Navier equations in spherical and cylindrical polars.

Several examples are given ; among them, an evaluation of the dynamic and static response of an elastic sphere to shear dislocations requires particular mention.

It is found that the static displacement field in a sphere which is associated with the Legendre polynomial of the first degree ($l = 1$) poses some problems. In such a case, one must incorporate additional conditions, namely, that the angular momentum of the sphere about its centre is zero and that the centre of mass of the sphere is not displaced.

It is recommended that eigenvector expansions be adopted in geophysical theory. Its inherent elegance and compactness make it an excellent tool for the construction of theoretical Earth-models".

188 - Schweiz Mineralogische und Petrographische Mitteilungen, v.48, n°1, 1968.

- a) McDOWELL F.W. & R. SCHMID. - "Potassium-Argon ages from the Valle d'Ossola section of the Ivrea-Verbano zone (Northern Italy)". S.205-210.
- b) GIESE P. - "Die Struktur der Erdkruste im Bereich der Ivrea Zone". S.261-284.

"During the period from 1956 to 1967 the crust of the Western Alps has been investigated by seismic refraction work. The steep gravity high of Ivrea, situated at the inner arc of the Western Alps, was an object of intensive seismic measurements. The problem of velocity-depth determination is discussed. For depth in the velocity range of 7.8 - 8.2 km/s the error of calculation is small (about 5-8 %). The determination of the width of a possible transition zone between the crust and the mantle is rather complicated, and therefore corresponding values vary from 0-10 km published by different authors. The existence of distinct low velocity layers inside the crust can be stated with certainty from travel-time graphs. But the intensity of such an inversion of velocity depends on the width calculated for the crust/mantle transition.

In the Western Alps there is an intensive low velocity layer which extends under the body of Ivrea too. But on the eastern side

of the gravity high (Po-plain) the basic material of the Ivrea-body has a link to the transition zone between the crust and mantle. The low velocity layer of the Western Alps diminishes under the western Po-plain.

From these seismic results, and from petrological considerations, the conclusion is drawn that in the area of the gravity high, between the basic rocks of the Ivrea-body and the upper mantle, sialic rocks must exist. The very intensive low velocity under the Ivrea body forces to the assumption of partly molten sialic rocks.

The zone of Ivrea is situated at the internal side of the Insubric Line, which separates the Central Alps from the Southern Alps. By the Alpine orogenic movements the whole crust of the Southern Alps/Po-plain block was thrusted over sialic rocks of the extern miogeosyncline. The frontal region of this "nappe" was straightened up by the tectonic process, and the deep seated rocks of the lower crust and the transition zone between the crust and the mantle are exposed today in the zone of Ivrea-Verbano".

- c) CORON S. & A. GUILLAUME. - "Sur les relations de la zone d'Ivrée avec ses bordures".
S.285-293.

"Ce travail préliminaire s'intègre dans le cadre d'une étude structurale des Alpes Occidentales par la méthode gravimétrique. Les données gravimétriques dont on dispose actuellement sont dues aux géophysiciens italiens (M. CUNIETTI, 1952 ; G. INGHILLERI, 1959), suisses (NIETHAMMER, 1900-1912 ; Schweiz. Geod. Kommiss., 1959) et français (S. CORON, 1959, 1964 et bibliographie ; S.CORON et A. GUILLAUME, 1966 ; A. GUILLAUME, 1967).

Le nombre de stations des Alpes franco-italiennes dont on connaît les anomalies de Bouguer corrigées du relief est maintenant d'environ 1.800. Il sera donc bientôt possible, avec les procédés modernes de calcul, de commencer des études quantitatives systématiques.

Le travail présenté ici expose brièvement et d'une manière semi-quantitative les données gravimétriques les plus récentes sur la zone d'Ivrée et ses bordures ; il compare ces données aux résultats géologiques et séismologiques".

- d) CARRARO F. & R. SCHMID. - "Bibliographie der Zone Ivrea-Verbano".
S.339-355.

- 191 - CANER B. & D.R. AULD. - "Magneto-telluric determination of upper mantle conductivity structure at Victoria, British Columbia".
 Contr. Dom. Obs., v.8, n°19, 12 p, Ottawa.
 from : Canadian J. Earth Sci., v.5, n°5, 1968.

"Magneto-telluric data were obtained at Victoria over a very wide range of periods (2 s to 86.400 s). Only the data up to 15.000 s periods were used for interpretation of conductivity structure, since telluric data at longer periods were dominated by ocean-tidal effects, spectral analysis of one year's data was used to demonstrate the tidal effects. The telluric signals are strongly polarized in the whole frequency range, indicating an anisotropy in surface conductivity.

The data indicate the existence of a finite conducting layer 10 ± 3 km thick and resistivity 100-125 ohm-meters, at a depth of 65 ± 5 km. A high resistivity zone (of the order of 4.000-5.000 ohm-meters) lies below this layer. There is no evidence for any further conducting zones down to a depth of at least 750 km".

- 192 - WEBER J.R. & A.K. GOODACRE. - "An analysis of the crust-mantle boundary in Hudson Bay from gravity and seismic observations".
 Contr. Dom. Obs., n°245, 7 p, Ottawa.
 from : Canadian J. Earth Sci., v.5, n°5, 1968.

"A study of the results of the gravity and seismic surveys in Hudson Bay in 1965 has shown that the gravitational effect of a two-layer model based on the seismically determined depths has no correlation with the observed gravity anomalies. On the profile from Churchill to Povungnituk the gravity and seismic observations can be reconciled by postulating lateral variations of the acoustic compressional wave velocity within the crust. A crustal model has been calculated - using the same time-terms and the same mean crustal velocity - whose gravitational effect fits the observed gravity. The velocity varies from 6.15 to 6.56 km/s and the postulated depths are almost entirely within the confidence limits of the original model.

In order to test the hypothesis, the postulated velocity variations has been compared with the lower refractor velocities of the shallow seismic survey, based on the assumption that the crustal velocities ought to be systematically higher than the crystalline surface velocities and that there may be a correlation between variations in crustal and surface velocities. The test is inconclusive because bottom refractor velocities are higher than crustal velocities in two areas where volcanic flows and high-velocity sediments may be present.

The case of linearly related velocity (V) and density (p) variations has been analyzed and it is shown that the gravitational effect of the crust-mantle boundary undulations may be completely masked or even overbalanced by density changes in the crust if $dp/dV \geq 0.11 \text{ g cm}^{-4} \text{ s}$. The crust can be characterized by having dominant velocity variations (in which case the gravity anomaly reflects the undulations of the crust-mantle boundary) or dominant density variations (in which case the gravity anomaly inversely reflects the crust-mantle boundary undulations) depending on the relationship between average crustal density and average crustal velocity".

- 195 - RAPP R.H. - "Comparison of two methods for the combination of satellite and gravimetric data".
AFCRL-68-0386, Rep. n°113, Sci. Rep. n°22, 36 p, Columbus, 1968.

"One method for the combination of satellite and gravimetric data consists of a comparison of a potential coefficient found by satellite analysis with the coefficient found by the usual summation process applied to a global estimate of a terrestrial anomaly field. A second method compares an anomaly computed from a set of potential coefficients found from satellite analysis with the observed terrestrial estimate. The specific equations for the adjustment procedure are derived and compared. It is shown that the results for the potential coefficients will only be the same when the anomalies have the same standard errors. Numerical tests were made with both methods by solving for potential coefficients to $n = 14$ and the adjusted $5^\circ \times 5^\circ$ field. Although no conclusive tests were found that indicated one method yields truer coefficients than the other, the second method appears to be preferred when judged by the agreement of anomalies computed from the coefficients with actual terrestrial estimates".

- 196 - MALAHOFF A. & R. MOBERLY. - "Effects of structure on the gravity field of Wyoming".
Geophys., v.33, n°5, p.781-804, 1968.

"A density model of the upper crust of Wyoming, computed on structural and petrographic evidence without prior reference to gravity data, when compared with the observed gravity field, demonstrates that :

- Existing measurements and theory of change of sedimentary rock density with depth of burial are satisfactory for gravity interpretation for local rock types and the slower rates of sedimentation in the area.

- Gravity stations established over sedimentary basins are generally as satisfactory as those on basement rock outcrops for depicting regional Bouguer gravity trends.

- The Laramide deformation was mainly germanotype.

The regional gradient in Bouguer gravity across Wyoming has increasingly negative values to the southwest. Local variation in the Bouguer anomaly field is related mainly to the low density Cretaceous and Cenozoic sediments of the basins, and to a lesser degree to the Laramide structural blocks. Interpretation of the gravity field indicates that the blocks are bounded by near-vertical faults extending into the upper mantle, and that the uplifted blocks are undercompensated (i.e., rootless).

In order to lead to a reasonable depiction of isostasy for the region, plots of mean Bouguer anomalies versus mean elevation must be made over $2^\circ \times 2^\circ$ squares, or larger, because of the variation in structure and composition of the crust".

197 - DoD Gravity Library - "Quarterly accession list,
1 July - 30 Sept. 1968".
USAF, ACIC, 4 p, 1968.

198 - I.U.G.G. - Papers presented at the 9th Assembly of the
EUROPEAN SEISMOLOGICAL COMMISSION held 1 - 7 August 1966 in
Copenhagen.
Inst. Geophys., 1967.

- a) MECHLER P. - "Modèle de croûte terrestre déduit des différences de temps d'arrivée de signaux séismiques en deux stations voisines. Application à la Normandie".
p.139-146.
- b) CHOUDHURY M.A. & G. PERRIER. - "Anomalie du manteau supérieur en France".
p.147-153
- c) BEAUFILS Y. - "Expérience du Lac Blanc".
p.257-263.

- d) HINZ K. - S. PLAUMANN & A. STEIN. - "Geophysikalische Untersuchungen im Raum des Ringkjöbing-Fünen-Hochs".
p.285-292.
- e) POMERANTSEVA J.V. - A.N. MOSZHENKO - G.V. EGORKINA & J.A. SOKOLOVA. "Principal results of crustal and upper mantle investigations with the "Zemlia" recording units".
p.43-56.

199 - Trav. Inst. Geophys., Acad. Tchécosl. Sci., n°240-262,
Geofys. Sbor. 1966, v. XIV, Praha, 1967.

- a) BURSA M. - "Fundamentals of the theory of geometric satellite Geodesy".
p.25-63.
- b) VYSKOCIL V. & M. MOZISKOVÁ. - "Korrelation zwischen den Schwereanomalien und seehöhen in Mitteleuropa".
p.75-81.

200 - SOVIET GEOPHYSICAL COMMITTEE. - "Geophysical researches of crustal structure of South-Eastern Europe (Ukraine, Yugoslavia, Hungaria, East Carpathian, Czechoslovakia, German Democratic Republic, Bulgaria)".
Acad. Sci. USSR, Upper Mantle n°5, 159 p, Moscow, 1967.

201 - Stud. Geophys. Geod., Czechosl. Acad., v.3, n°12, Praha, 1968.

- a) BURSA M. - "Earth's flattening and harmonic coefficients of geopotential".
p.237-245.
- b) TRAGER L. - "Ausgleichung des tschechoslovakischen Gravimeternetzes".
p.246-258.
- c) MAN O. - "On the problem of computing derived fields in magnetic and gravity interpretation".
p.259-279.

- 202 - Stud. Geophys. Geod., Czechosl. Acad., v.4, n°12, Praha, 1968.
- a) ZATOPEK A. - "Half a century of development of Geodesy, Geophysics and Meteorology in Czechoslovakia (to the 50th Anniversary of Independent Czechoslovakia)".
p.333-338.
 - b) RADU C. & V. TOBYAS. - "Contribution to the investigation of small intermediate depth earthquakes in the Vrancea region".
p.402-406.
- 203 - COMITE GEODESIQUE POLONAIS - Geod. Kartogr., Akad. Nauk., t. XVII, n°2, p.91-177, Warszawa, 1968.
- 204 - COMITE GEODESIQUE POLONAIS - Geod. Kartogr., Akad. Nauk., t. XVII, n°3, p.183-271, Warszawa, 1968.
- 205 - MATHER R.S. - "The free air geoid in South Australia and its relation to the equipotential surfaces of the Earth's gravitational field".
Univ. New South Wales, UNISURV, Rep. n°6, 6 p, 1968.
- 208 - Travaux de l'ASSOCIATION INTERNATIONALE de GEODESIE,
Rapports généraux et techniques, Lucerne 1967, t. 23, Paris, 1968.
- a) TARDI P. & S. CORON. - "Activité du B.G.I., Paris 1963 - 1967".
p.265-270.
 - b) COOK A.H. - "Special study group 4.18, report on absolute measurements of Gravity".
p.271-278.
 - c) WORZEL J.L. - "Report on gravity at sea".
p.279-292.
 - d) BURSA M. - "Theoretical and practical achievements in determining the figure of the Earth and its external gravitational field, 1963-1967".
p.293-358.

- e) FISCHER I.- "Investigations concerning the astrogeodetic determination of the geoid on a common datum, combined with gravimetric and satellite interpolations".
p.359-365.
- f) ARNOLD K. & H. MONTAG. - "The activity of Potsdam group on West Alp test area of SSG 5.16".
p.383-388.
- 209 - GARLAND G.D. - "Chronique de l'U.G.G.I.". n° 73, p.101-164, 1968.
- 210 - CAHIERRE L. - "Comptes rendus du Comité National Français de Géodésie et Géophysique, année 1967". 105 p, 1968.
- 211 - GROSSMANN W. - "XIVème Assemblée Générale, Lucerne 1967, Comptes rendus résumés des séances des sections, section IV, Gravimétrie : Mesure de la pesanteur". Bull. Géod. n°90, p.421-425, 1968.
- 212 - MELCHIOR P. - "Marées terrestres". Obs. R. Belgique, Bull. Inf. n°52, Bruxelles, 1968.
- a) DITCHKO I.A. - "Certaines questions de la théorie du gravimètre Askania".
p.2417-2439.
- b) KORBA P.S. & I.A. DITCHKO. - "Sur les conséquences de l'amortissement dans les observations des variations de la force de pesanteur avec le gravimètre Askania".
p.2440-2443.
- 218 - JEDRZEJEWSKA M. & M. MAJEWSKA. - "The problem of the distribution of relative deflections of the plumb line in Poland". Proc., Inst. Geod. Cartog., t. XV, n°2(35), p.3-22, Warszawa, 1968.

- 219 - REICHENEDER K. - "Die lokalen Schwereverhältnisse im Geodätischen Institut Potsdam".
Z. Vermesswes. & Kart. Wissensch. & Praxis, v.16, H.9, S.321-326,
1968.
- 220 - GIESE P. - "Versuch einer Gliederung der Erdkruste im nördlichen Alpenvorland, in den Ostalpen und in Teilen der Westalpen mit Hilfe charakteristischer Refraktions-Laufzeit-Kurven sowie eine geologische Deutung".
Geophys. Abhandlungen B.1, H.n°2, 202 S, Berlin, 1968.
- 221 - BEDFORD INSTITUTE - "Cruise report n°257, C.S.S. HUDSON, B.10,
1958-1968 (Nova Scotia Continental Shelf)".
Atlantic Ocean. Lab., Data Rep. n°1968, 13-D, 8 p, 1968.
- 222 - BEALS C.S. & I. HALLIDAY. - "Terrestrial meteorite craters and their lunar counterparts".
Contr. Dom. Obs., v.7, n°4, 10 p, Ottawa, 1968.
from : Inter. Dictionary Geophys., v.2, 1967.
- 223 - BUCK R.J. - "The gravity anomaly field in Western Canada with maps, part II :
- n°37 : Brandon-Dauphin (Saskatchewan - Manitoba)
- n°38 : Swift Current-Regina (Saskatchewan)
- n°44 : Pasquia Hills-Swan River (Saskatchewan - Manitoba)
- n°49 : Winnipeg - Gypsumville (Manitoba) ".
(scale : 1/500.000°, density : 2,67).
Grav. Map Ser., Dom. Obs., 9 p., Ottawa, 1968.
"Many difficulties were encountered in the preparation of these maps. First, this project was undertaken at a time when the Gravity Division was converting to the use of electronic computing systems for routine data processing. The required computer programs were either in a state of development or had to be specially written and tested.

Second, the facilities for repeated plotting and checking of large amounts of data were not available until the automatic data plotter was acquired in 1964. Errors found at this time necessitated the reprocessing of some of the data.

Third, this project provided us with our first experience in the compilation and conversion of large amounts of data from external sources. We experienced difficulty in converting the oil company data and were unwilling to discard large blocks of it when the problems were first encountered. From our experience we suggest that in the future all data submitted for

incorporation in the gravity Map Series should be in original traverse form. Furthermore, if an outside agency is planning such a gravity survey, the Observatory will provide the advice and assistance that is necessary for the conduct of the survey and the processing of the observations. In conjunction with a more advanced computing system now being developed, this will increase the speed with which the data are published and will ensure conformity with the national gravity standard".

224 - HORNAL R.W. - "The gravity anomaly field in the Coppermine Area of the Northwest territories with map".

Grav. Map Ser., Dom. Obs., 9 p, Ottawa, 1968.

Gravity map n°45 - Coppermine, scale : 1/500.000°, density : 2,67.

"A regional gravity survey in the area between Great Bear Lake and Coppermine, N.W.T. revealed a large 60 mgal gravity high which is related to the Coppermine basalt flows, the Muskox ultrabasic intrusion and the diabase dike swarms in the area . Secondary features include gravity highs along the north shore of Great Bear Lake and South of the Muskox intrusion, and gravity lows attributed to granites, in the vicinity of the Dismal Lakes and Coronation Gulf. A detailed gravity survey over the Muskox intrusion showed a smoother gravity field than expected, probably because a considerable portion of the dense olivine-rich layers of the intrusion have been altered to less dense serpentine".

226 - WHITE W.R.H. - M.N. BONE & W.G. MILNE. - "Seismic refraction surveys in British Columbia, 1964-1966 : a preliminary interpretation".

Contr. Dom. Obs., v.8, n°2, Ottawa, 1968.
from : Canadian Contr., Upper Mantle Project n°143,
Geophys. Monograph n°12.

"Seismic refraction studies between 1964 and 1966 in the interior plateau and ranges of British Columbia are described. A reversed profile along the interior plateau from Quesnel to Merritt with an unreversed extension to the U.S. border has been interpreted in two ways. The preferred solution in terms of rms fit shows that the transition from subnormal to normal P_n velocity takes place north of Clinton. The mantle-crust boundary undulates several kilometers, and the crust is on the average 30 km thick. There is no evidence for an intermediate layer, and the upper basement velocity is uniform at 6.1 km/sec. Observations from the Ripple Rock explosion of 1958 and another profile southwest from Revelstoke are difficult to reconcile, since they require a rapid crustal thinning between Kamloops and Hope, B.C., where the inferred depth is only 28 km. A second solution suggests a uniform P_n velocity of 8.0 km/sec. and crustal thinning towards the north in the interior plateau and to the west across the interior ranges and plateau. Crustal depths vary from 34 to 28 km in the area. The fit to the observations with this model is not quite so good, but observation parallel and perpendicular to the physiographic strike can be reconciled with gentler dips. Again no intermediate layer velocity can be determined. Neither seismic model fits a naïve interpretation of the gravity data available, and the magnetic variation results are insufficient to help distinguish between them. The uniformly thin crust and the negative Bouguer anomalies suggest that the upper mantle low velocity layer must be at shallow depth in central British Columbia".

- 227 - MELCHIOR P. & B. GEORIS. - "Earth tides, precession-nutation and the secular retardation of Earth's rotation".
Obs. R. Belgique, Comm. Ser. A, n°4, Ser. Geophys. n°86, 20 p,
Bruxelles, 1968.
from : Physics Earth & Planetary Interiors, v.1, 1967.

"It is shown that both the precession nutation in space of the axis of inertia and the diurnal nutations inside the Earth of the instantaneous axis of rotation are produced by the horizontal components of the tesseral diurnal tidal force.

Frequencies and amplitudes of the nutation can be computed from those of the tides by two theorems demonstrated here. It is shown also that the analysis of very long series of tidal force records by means of horizontal pendulums and gravimeters confirms the recent theories on the dynamic effects of a liquid Earth's core. This implies that correction have to be taken into account when calculating short period nutations.

The retardation of the Earth's rotation is acceded in considering the phase of the radial strain produced by the sectorial Earth tides and evidenced by gravimetric observations".

228 - Mitt., Zurich Inst. Geophysik, n°47, 1968.

- a) VALLABH SHARMA P. - "High speed gravity and magnetic calculations of uniform cylindrical bodies of arbitrary cross-section and finite length".

p.48-53.

from : Pure & Applied Geophys., v.65, n°II, 1966.

"A simple method is designed for programming the gravity and magnetic calculations of a right circular cylinder (vertical or horizontal) by treating it as a combination of thin rectangular slabs. It takes only a few seconds to compute a profile of each kind and the accuracy is comparable to that obtained by using exact expressions (involving complete elliptic integrals) instead. The method is also applicable to cylindrical bodies of arbitrary cross-section and could as well be used for rapid computation of derivatives of gravity and magnetic anomalies".

- b) VALLABH SHARMA P. - "Graphical evaluation of magnetic and gravity attraction of three-dimensional bodies".

p.167-173.

from : Geophys. Prospecting, v.XV, 1967.

"A monogram is presented which enables evaluation of the components of magnetic attraction of a homogeneous finite rectangular prism, and of gravitational attraction due to a uniform rectangular lamina.

In practice any three-dimensional body could be approximated by a number of right rectangular prisms of varying dimensions governed by the shape of the body. The magnetic attraction of the whole body is then obtained by numerical summation of the effects of the constituent prisms.

For evaluating the gravitational effect, the cross-section of the body corresponding to each elevation contour is approximated by a number of rectangular laminae (or by a stepping polygon) the attraction of which can be determined with the aid of the same monogram. The total gravitational attraction of the body is obtained by a process of graphical integration along the vertical axis".

- 229 - HAASE H.S. - "Zur Frage der Messung oder Berechnung vertikaler Schweredifferenzen".
Inst. Theor. Geod., Univ. Bonn, 121 S, 1968.
- 231 - ZIELINSKI J.B. - "Application of the radius vector of artificial satellite as length measure for geodetic purposes".
Politec. Warszawa, Prace Nauk. Geod., n°1, p.7-142, 1968.
- 232 - BURSA M. - "On the determination of gravimetric deflections of the vertical for the centre area".
from : Trav. Inst. Geophys., Acad. Tchecosl. Sci.,
n°263, p.13-50, Praha, 1967.
- 235 - RECHENMANN J. - "Etude gravimétrique du gisement de chromite de Bemanevika".
ORSTOM, Ser. Geophys., Cahiers n°9, p.3-26, 1968.

- 237 - WITTE B. - "Die Berechnung von Horizontalableitungen der Schwerestörungen im Außenraum der Erde aus einer Entwicklung des Potentials nach Kugelfunktionen".
D.G.K., R.C : Dissert., H.n°122, 89 S, München, 1968.
- 238 - HEILBRONNER H. - "Eine Studie über den Aufbau eines räumlichen geodätischen Netzes aus terrestrischen Beobachtungen".
D.G.K., R.C. : Dissert., H.n°126, 60 S, München, 1968.
- 248 - KLECZEK R. - "Determination of the constants and working formulae of the torsion balance".
Politec. Warszawa, Z. Nauk. Geod., n°22, p.93-138, 1968.

"The methods determining the value of particular constants of the torsion balance are described in this paper. Practical usability of some methods has especially been stressed. The accuracy in determination of constants has been analysed and the working formulae allowing to define the value of second derivatives of the gravity inferred. As result of examination the constant values for a small torsion balance made by MOM in Budapest have been presented. For the same torsion balance some practical formulae suitable for observations containing three - four - or five azimuthal cycles have been worked out".
- 249 - MATHER R.S. - "The free air geoid as a solution of the boundary value problem".
Geophys. J., R. Astr. Soc., v.16, n°5, p.515-530, 1968.

"The assumptions made in solving the boundary value problem are critically examined and revised expressions derived for the complete definition of the non-regularized geoid to the order of the flattening. The free air geoid is shown to be a good approximation to the non-regularized geoid. The relation between regularized geoids and the non-regularized geoid is established and the latter is shown to be no more difficult to compute than any regularized geoid.

Expressions are developed for the computation of the height anomaly from free air anomalies and elevations to the order of the flattening. The significance of the zero order term is examined and its implications in assigning revised values for the parameters defining the reference system are examined".

- 250 - BLUNDELL D.J. & R. PARKS. - "A study of the crustal structure beneath the Irish Sea".
Geophys.J., R. Astr. Soc., v.17, n°1, p.45-62, 1969.

"An explosion study was undertaken in 1965 to investigate the structure of the crust in the Irish Sea area. The experiment was designed to permit the use of the time term approach to interpret the data. Seismic waves from twenty-five depth charges were recorded at three temporary seismometer stations in Wales and one in Ireland, the Rookhope Borehole and the U.K.A.E.A. array at Eskdalemuir. Detailed geophysical surveys made across Cardigan Bay and St-George's Channel have provided information about the shallow structures. P_g , P^* and P_n arrivals were identified on the records, and the velocities were calculated to be 6.1, 7.3 and 8.1 km s^{-1} respectively. P_n was observed only at Eskdalemuir and Rookhope and the value determined represents in effect only an apparent velocity. P^* , however, was observed at the Irish and the three Welsh stations, and its velocity and the associated time terms are well determined. The calculated values of the P_g velocity and time terms have relatively large uncertainties, due probably to the heterogeneous nature of this layer. The shallow structures are complex and as a result it is difficult to translate from time terms to interface depths. A simplified crustal model, making use of average values of the time terms, is made up of three crustal layers with interfaces at depths of 4 km and 24 km and the Moho at a depth of 30 km".

- 251 - RAMSAYER K. - "Erprobung und Erweiterung des Verfahrens der räumlichen Triangulation in einem lokalen kartesischen Koordinatensystem".
D.G.K., R.A : Höhere Geod., H.n°60, 30 S, München, 1968.

"For the rigorous three-dimensional determination of the positions of the points of a geodetic network normally an ellipsoidal reference system is used. In this case for each point six unknowns are to be determined, namely latitude, longitude, height, the north and east component of the deviation of the vertical and the station correction of the observed bearings. If the ellipsoid is replaced by a local Cartesian coordinate system, whose z-axis coincides with the true vertical of an arbitrary selected central point of the network, and whose x-axis is oriented to astronomic north, and if the measured vertical and horizontal angles are transformed to parallels of the z-axis, the number of unknowns is reduced to four, because the components of the deviation of the vertical are suppressed.

A further advantage is, that if the vertical angles and the astronomic azimuth of a line are measured from both sides a simple control of the measured values is possible before the adjustment.

The new method, proposed by the author already 1965, was improved and checked in a quadrangle in the Swiss Alps, which was observed by the Swiss Geodetic Commission. The local Cartesian coordinates were transformed in ellipsoidal coordinates and compared with the corresponding coordinates published. The method may be used for networks up to about 1.000 kilometers diameter".

252 - Comm. Geod. Ital., 3rd Symposium on Mathematical Geodesy, Bologna, 1966.

- a) MORITZ H. - "Differential and integral aspects in physical geodesy".
p.55-66.

"Differential and integral aspects are illustrated by the role of initial value and boundary value problems as applied to the gravimetric determination of the figure of the Earth and its external gravity field. The relationship between gravity and the form of the level surfaces, and the meaning of reference figures are discussed".

- b) BJERHAMMAR A. - "On the stability of the solution of the gravimetric boundary value problem".
p.67-78.

" - A unique solution of the gravimetric boundary value problem can only be obtained if the solution does not include more unknown quantities than the number of measurements. All other solutions are unstable.

- "Analytical methods" which have been described as "hypothesis free" include an infinity of degenerations if they are applied on a gravity field presented by the aid of discrete gravity data. (A unique solution can only be obtained by the aid of some additional hypothesis concerning the "continuation" of the gravity information).

- The "discrete analysis" described here considers the gravimetric boundary value problem to have gravity data given only at discrete points. The solution therefore includes a prediction of gravity for the missing points. The stability of the solution is dependent on the degrees of freedom".

- c) TENGSTROM E. - "On the solvability conditions of the integral equations of the boundary value problem in geodesy and on the different numerical solutions of the equations".
p.79-103.
- d) CAPUTO M. - "A simple model for the Earth gravity field".
p.119-130.
 "A close equipotential surface of the Earth's non rotating gravity field (normal or actual) can be approximated with an ellipsoid of revolution with an accuracy of a few parts per million.
 Assuming this ellipsoid as an equipotential surface we develop the formulae of the field and illustrate some of its properties. All the formulae are extremely simple and among the properties we find that all the equipotential surfaces of the field are ellipsoids confocal to the first one. The departures of this field from the Earth's normal field are less than one part per million.
 We give also a comparative table with the spectra of several models of the Earth's gravitational potentials and another table with some space gravity values of this model field specialized with the parameters recently suggested by I.A.G. and adopted by I.A.U.".
- e) BOZZI ZADRO M. & A. GREGORI CARMINELLI. - "Représentation conforme du géoïde sur l'ellipsoïde international".
p.131-139.

253 - KRUGER H. - "Perioden des troposphärischen Windvektors und Schwankungen der Erdrotation und der Polhöhe".
Gerlands Beitr. Geophys., 77, H.6, S. 440-452, Leipzig, 1968.

"The seasonal variations of the rotation of the Earth and the movement of the pole are compared with monthly mean tropospheric wind vectors of the direction west-east and north-south. A connection is shown between periods of the wind vectors and periods in the fluctuation of the Earth rotation as well as the movement of the pole".

254 - KOCH K.R. - "Numerical examples for downward continuation of gravity anomalies".
AFCRL-68-0513, Rep. n°112, Sci. Rep. n°23, 25 p, 1968.

"To compute gravity anomalies at the surface of the Earth from airborne gravity measurements Poisson's integral for the plane applied to gravity anomalies is regarded as an integral equation of the first kind, whose solution gives the sought anomalies. In the practical application the integration is replaced by a summation, so that a system of linear equations is obtained. This system is solved by successive approximations. Several examples are computed to continue anomalies downward in the centers of 5' x 5', 15' x 15' and 1° x 1° blocks at elevations of 6 km and 8 km. The results show that the successive approximations converge fast. In case of flight elevations between 6 km and 10 km, however, the use of 5' x 5' blocks and of smaller blocks should be excluded from the downward continuation of airborne gravity measurements to avoid ill-conditioned matrices".

255 - MORITZ H. - "Density distributions for the equipotential ellipsoid". AFCRL-68-0563, Rep. n°115, Sci. Rep. n°24, 54 p, 1968.

"Part I deals with a general method of finding regular mass distributions for the equipotential ellipsoid ; the method is illustrated by a simple model consisting of a homogeneous core and a nearly homogeneous mantle. In Part II continuous density models using finite closed polynomials are investigated with a view to finding the simplest expressions that are consistent with the general trend of the distribution of density as represented by Bullard's density law. The subjects of Part III are special topics such as potential and gravity inside the Earth, some unsolved problems being pointed out".

256 - Boll. Geof. Teor. Appl., v.X, n°40, 1968.

- a) CARROZZO M.T. & F. MOSETTI. - "Filtering of Bouguer map and frequency distribution of gravimetric anomalies in the northern Italy".
p.267-280.

"Successive residuals of gravity anomalies for the Po Valley region are calculated by linear combinations method. From the original map of observed values we obtain differently smoothed or filtered maps which represent some distribution of the anomalies. The latters are separated in relation to their extension. The results of these operations are discussed. For some residual anomalies a quantitative interpretation attempt has been carried out".

- b) CECCHERINI P.T. & I. FINETTI. - "Density computation problem of compactable rocks for gravity reduction".
p.281-289.

"After some general remarks about density variation with depth for compactable geological formations, an approach to the determination of the average density for gravity survey computation is presented. Some examples are applied for typical compactable formations".

- c) HENKEL H. - "Direct interpretation of 2-dimensional gravity anomalies with a self-adjusting procedure using a digital computer (Part I, Theoretical considerations)".
p.299-317.

"In this paper a convenient method is presented for the evaluation of 2-dimensional gravity anomalies. The disturbing body, of which one horizontal surface is known, is approximated by infinite vertical prisms, and the unknown surface is automatically adjusted to the measured anomaly. A computer programme in Algol 4 language is presented, which includes models with both end-corrections and several density anomalies. The iterative process is tested for its convergence for various starting solutions and geometrical relations of the approximation prisms".

- d) KOCH K.R. - "Alternate representation of the Earth's gravitational field for satellite geodesy".
p.318-325.

"Instead of an expansion into spherical harmonics, the Earth's potential is separated into the normal part and the disturbing potential according to the procedure when solving the geodetic boundary value problem. The normal potential is given by an expansion into spherical harmonics of low degree with coefficients known from satellite observations. The disturbing potential is represented as a potential of a simple layer distributed at the Earth's surface whose unknown density will be obtained by orbital analysis. The density is connected with the gravity anomaly by an integral equation so that known anomalies can be included in the solution for the density".

- e) MORITZ H. - "On the computation of the deflection of the vertical".
p.326-331.

"If the correction term for the gradient solution is computed from topography only, the deflection of the vertical so obtained will be strictly equivalent to the result of applying Vening Meinesz' formulas to the free-air anomalies modified by adding the terrain correction. A direct proof of this equivalence is given".

- f) CARROZZO M.T. - "Indirect interpretation method of gravimetric and magnetic anomalies by electronic computer".
p.341-350.

"Some templates to calculate the gravimetric and magnetic anomalies by electronic computation are presented. A way for using the indirect method of interpretation through opportune templates by electronic computers is then shown. Obviously, the employ of the electronic computation does not avoid the indetermination connected with the potential methods ; however, it allows to repeat at high speed the interpretation for numerous geological hypothesis and to choose the most reliable one".

- 257 - OBENSON G.F.T. - "Prediction accuracies of $5^\circ \times 5^\circ$ mean anomalies from $1^\circ \times 1^\circ$ means at different latitudes".
AFCRL-68-0642, Rep. n°117, Sci. Rep. n°26, 39 p, 1968.

"Covariance functions for $5' \times 5'$ and $1^\circ \times 1^\circ$ blocks are derived from the covariance function for point anomalies at different latitudes. Using the $1^\circ \times 1^\circ$ covariance function at certain latitudes and different $1^\circ \times 1^\circ$ configurations, prediction accuracies for $5^\circ \times 5^\circ$ blocks are studied for three different methods. It is shown that the accuracies are generally the same for any one method at different latitudes for any given $1^\circ \times 1^\circ$ configuration. If the number of $1^\circ \times 1^\circ$ blocks in any $5^\circ \times 5^\circ$ block is more than about ten, the arithmetic mean method gives practically the same accuracy as the minimum variance method even if all known $1^\circ \times 1^\circ$ blocks are used".

- 258 - GARLAND G.P. - "Comptes rendus de la XIV Assemblée Générale de l'U.G.G.I.".
Zurich, 25 Septembre - 7 Octobre 1967, 275 p, 1967.

- 259 - Association Internationale de Géodésie, Bull. Géod. n°91, 1969.

- a) YEREMEYEV V.F. & M.I. YURKINA. - "On orientation of the reference geodetic ellipsoid".
p.13-16.
- b) HOTINE M.& F. MORRISON. - "First integrals of the equations of satellite motion".
p.41-45.
- c) RAPP R.H. - "The geopotential to (14,14) from a combination of satellite and gravimetric data".
p.47-80.

"A set of 2261 $5^\circ \times 5^\circ$ mean anomalies were used alone and with satellite determined harmonic coefficients of the Smithsonian Institution to determine the geopotential expansion to various degrees. The basic adjustment was carried out by comparing a terrestrial anomaly to an anomaly determined from an assumed set of coefficients. The (14,14) solution was found to agree within ± 3 m of a detailed geoid in the United States computed using $1^\circ \times 1^\circ$ anomalies for an inner area and satellite determined anomalies in an outer area. Additional comparisons were made to the input anomaly field to consider the accuracy of various harmonic coefficient solutions.

A by-product of this investigation was a new $\gamma_E = 978.0463$ gals in the Potsdam system or 978.0326 gals in an absolute system if - 13,7 mgals is taken as the Potsdam correction. Combining this value of γ_E with $f = 1/298.25$, $KM = 3.9860122 \cdot 10^{22} \text{ cm}^3/\text{sec}^2$, the consistent equatorial radius was found to be 6378143 m.".

- d) MORITZ H. - "Sur la répartition de densité à l'intérieur de l'ellipsoïde equipotentiel".
p.81-93.

"A general solution of the problem of density distribution for the equipotential ellipsoid is applied to obtain some special models".

- 262 - ACADEMIE des SCIENCES U.R.S.S. - "Références bibliographiques - Géophysique".
1er t., 283 p, Moscou, 1969

Références bibliographiques classées par matière :

- Géomagnétisme
- Météorologie
- Océanographie
- Physique de la Terre
- Méthodes en géologie et en géochimie.

263 - ACADEMIE des SCIENCES U.R.S.S. - "Références bibliographiques - Géophysique".
2ème t., 244 p, Moscou, 1969.

264 - ACADEMIE des SCIENCES U.R.S.S. - "Références bibliographiques - Géodésie".
n°52, t.1, 48 p, Moscou, 1969.

Références bibliographiques classées par matière :
- Géodésie, Astronomie
- Photogrammétrie
- Topographie et Cartographie.

265 - ACADEMIE des SCIENCES U.R.S.S. - "Références bibliographiques - Géodésie".
n°52, t.2, 44 p, Moscou, 1969.

266 - BARKER P. - "Interpretation of Ocean floor lineations".
Quart. J., R. Astr. Soc., v.10, n°1, p.46-49, 1969.

268 - Geophys. J., R. Astr. Soc., v.17, n°2, 1969.

- a) BULLEN K.E. & R.A.W. HADDON. - "Upper bound to change in incompressibility at the Earth's mantle-core boundary".

"A series of Earth models has been constructed in which the excess Δk of the incompressibility at the top of the Earth's core over the value k at the bottom of the mantle has been given the assigned values 0, 0.05, 0.1, ... $\times 10^{12}$ dyn/cm². The calculations indicate that unless the assumed seismic velocities and density gradients are more seriously in error than expected, $\Delta k/k$ does not exceed 2 per cent. The most probable value of $\Delta k/k$ is insignificantly different from zero. A comparison is made with results on the variations of k inside the Earth from Birch's finite-strain formulae ; Birch's results appear to be wholly reconcilable only with difficulty with results on k on Bullen's approach. The present calculations suggest that one of three possibilities is the case :
1) Birch's formulae fall a little short of fitting conditions near the Earth's mantle-core boundary ; or

- 2) The chemical compositions of the lower mantle and outer core are less different than Birch and some others have thought likely ; or
- 3) The average temperature gradient is rather higher and the average density gradient appreciably lower inside the lower mantle than has been considered likely in most earlier calculations of Bullen. To meet the numerical requirements of the present calculations, the possibility 3) would appear to require a fairly extreme combination of circumstances".
- b) DORE B.D. - "The attenuation of short gravity waves propagating in turbulent conditions".
p.203-208.
 "An application of boundary layer theory is made to determine the attenuation of progressive waves in fluid of infinite depth. The turbulence in the flow is expressed mathematically by means of a system of (variable) coefficients of eddy viscosity. The principal contribution to the damping is found to be independent of surface turbulence and dependent on integrals involving the eddy viscosities over the depth of the fluid".
- c) TRAMONTINI C. & D. DAVIES. - "A seismic refraction survey in the Red Sea".
p.225-241.
 "Intensive seismic refraction work has been carried out in the Red Sea in a small area centred on $22^{\circ}30'N$, $37^{\circ}00'E$. Below water depths of 600 to 1400 m., material with a mean seismic velocity of 4.3 km s^{-1} overlies a layer of mean seismic velocity 6.6 kms^{-1} . The refracted arrival times indicate that the depth to the deep layer varies typically between 3 and 6 km but that the layer is horizontally continuous. A velocity of 6.4 km s^{-1} was measured over the central deep trough and it is suggested that the high velocities are those of new crustal material emplaced in the process of separation of the Arabo-Nubian continental blocks by at least 130 km, measured perpendicular to the Red Sea axis. This hypothesis is discussed in the light of existing gravity and magnetic observations in the area".
- 270 - BOKUN J. - L. CICHOWICZ - W. DOBACZEWSKA - C. KAMELA - S. DRYNSKI - M. ODLANICKI-POCZOBUTT & W. OPALSKI. - "Rapport sur les travaux géodésiques exécutés en Pologne de 1963 à 1967".
Geod. Kart., t. XVIII, n°1, p.77-89, 1969.

273 - BURSA M. - "On the figure of the Earth's equipotential surface from satellite orbit dynamics".
from : Studia Geophys. & Geod., n°13, 12 p, Prague, 1969.

274 - BUCHBINDER G.G.R. - "Properties of the core-mantle boundary and observations of PcP".
Contr. Dom. Obs., v.8, n°22, 23 p, Ottawa, 1968.
from : J. Geophys. Res., v.73, n°18.

"Study of PcP phases from eight explosions and three earthquakes shows that the initial direction of motion of PcP reverses at an epicentral distance of about 32° and that PcP amplitudes pass through a minimum at this distance. The effects are caused by properties of the core-mantle boundary. Calculations of reflection coefficients at a plane solid-liquid boundary show that a model with P and S velocities at the bottom of the mantle of 13.64 km/sec and 7.30 km/sec, respectively ; with a P velocity at the top of the core of 7.5 km/sec ; and with a ratio of core density to mantle density of 1.0 will satisfy the observations of amplitude and change of initial phase of PcP. A range of similar models with velocities at the top of the core down to 7.2 km/sec and density ratios as high as 1.05 will also satisfy the observations. Amplitude observations of PKKP phases also satisfy the model. The new structure is in sharp contrast to the structure of conventional models that have a core velocity of about 8.1 km/sec and a density ratio of about 1.7, but such models will not satisfy the new data. One way to reconcile the new structure near the core-mantle boundary with other relevant information is to assume a model in which the lowermost mantle is inhomogeneous. The inhomogeneity is caused by an increase in iron or other heavy metal content with depth, which increases the mean atomic weight and the density with little change in P velocity. The drop in P velocity across the core-mantle boundary may then be explained by a step increase in mean atomic weight with little change in density. The Adams-Williamson equation will not be valid in the regions in which the changes in density and mean atomic weight are postulated. The incompressibility is not continuous across the core-mantle boundary. PcP travel-time observations do not permit resolution of irregularities at the core-mantle boundary of less than about 5° in slope and about ± 5 km in height. The scatter of the observed travel times from a least-squares fit does not indicate slopes of over 6° or elevation differences much over 5 km on the core-mantle boundary".

- 275 - SAXOV S. - "Gravimetry in the Faroe Islands".
Geod. Inst., Medd. n°43, 23 p, Copenhagen, 1969.
Faroe Islands maps :
scale : 1/100.000°, density : 2,67
Map 1 - Free air anomalies
Map 2 - Bouguer anomalies
Map 3 - Bouguer anomalies - Topographic corrections.
- 279 - COLLETTE B.J. - "On the subsidence of the North Sea Area".
from : Geology of Shelf Seas, p.15-30, 1968.
- 280 - COLLETTE B.J. - R.A. LAGAAY - A.P. Van LENNEP - J.A. SCHOUTEN & R.D. SCHUILLING. - "Some heat-flow measurements in the North Atlantic Ocean".
Kkl. Nederl. Akad. Wetensh., Amsterdam.
from : Proc., Ser.B, v.71, n°3, p.203-208, 1968.
- 281 - LAGAAY R.A. & B.J. COLLETTE. - "A continuous seismic section across the Continental slope off Ireland".
from : Marine Geology, n°5, p.155-157, 1967.
"Continuous seismic reflection data show that there are no unconsolidated sediments on the outer part of the Irish continental shelf west of Donegal Bay and on the upper part of the slope. Both the "basement" and the sediment cover on the lower part of the slope are heavily intersected, presumably by faults".
- 282 - LAGAAY R.A. - B.J. COLLETTE & J.A. SCHOUTEN. - "Seismic profiling in the North Sea Basin".
Geol. Mijnbouw., n°10, p.351-355, 1967.
"Seismic sections of the upper sedimentary layers and an isochron map of the base Tertiary in the southern part of the North Sea basin are presented. They are the result of an instrument testing program with an air gun profiler. Several structural features of the Cenozoic can be correlated with the geology of adjacent areas. An important aspect of the formation of the North Sea basin is the differential sagging, leading to the formation of subbasins that shift place in time".

- 283 - COLLETTE B.J. & R.A. LAGAAY. - "A continuous reflection profile along the Netherlands coast from Walcheren to Den Helder".
Geol. Mijnbouw., n°8, p.265-268, 1966.

"A reflection profile along the Netherlands coast from Walcheren to Den Helder is presented, obtained with the so-called air gun profiler. The penetration was one second.

The down-dipping of the layers from the Brabant massif, the extension of the Saxonian "anticlinal" zone Rotterdam - The Hague, and the thickening of the sediments towards the North are recognized.

The base Quaternary and the base Tertiary are tentatively identified".

- 284 - Geophys.J., R. Astr. Soc., v.17, n°3, 1969.

- a) WHITE R.E. - "Seismic phases recorded in South Australia and their relation to crustal structure".
p.249-261.

"The phases recorded from local earthquakes in South Australia are discussed. A simple single-layered crustal model, put forward by Doyle & Everingham (1964) from recordings of atomic explosions, has provided very consistent interpretations of all the prominent phases. The Mohorovicic discontinuity appears to be sufficiently sharp to produce the converted reflection S_{MP} at frequencies near 2 c/s. Normal super-critical reflections and a surface converted reflection s_{MP} are also regularly recorded. The converted reflections are very useful for the determination of focal depths ; their recorded amplitudes give added weight to the hypothesis of almost constant crustal velocities. They illustrate the usefulness of later phases in studies of crustal structure and the advantages of using relatively long wavelengths, particularly for studying reflections. The amplitude data for P waves were found to give little useful information but satisfactory agreement was obtained between the observed amplitudes of SMS , S_{MP} and s_{MP} and the amplitudes calculated for these phases using ray theory and plane wave reflection coefficients".

- b) GEDNEY L. & E. BERG. - "Some characteristics of the tectonic stress pattern in Alaska".
p.293-304.

"Horizontal azimuths of tectonic "pressure" are plotted for 38 small and intermediate earthquakes recorded in Central Alaska by a six station network during the period October 1967 - September 1968.

Two potential mechanisms were considered in evaluating P-wave data from the shocks. The first assumed lateral motion on vertical fault planes, while the second considered the possibility of normal faulting on vertical, or near vertical planes. Although many deeper-than-normal shocks occur in the region under investigation, they do not appear to be consistent with either of these simplified mechanisms. Of the 38 events considered, only one was at a depth significantly in excess of crustal thickness in the region.

The results of this study suggest that maximum tectonic pressure is being exerted in a direction normal to the continental margin in the area of Cook Inlet, while block-faulting is occurring in the northernmost portions of the Alaska Range. Between these two areas, on the inside of the sharp bend formed by the Alaska Range, maximum compressive stress is being exerted in a direction parallel to the mountain front, implying that further "bending" of the range may be occurring. This is the condition which would be expected if this portion of the Alaska Range is performing in the manner of a hinge as is stated in Carey's (1956) "Alaskan Orocline" theory of continental drift".

- 285 - WOOLLARD G.P. - J. MONGES CALDERA & J.A. KOZLOSKY. - "A network of modern gravity control bases in Central America and South America". Geof. Int., v.6, n°2, p.39-69, 1966.
- 286 - WOOLLARD G.P. - J. MONGES CALDERA - J.C. ROSE & J.A. KOZLOSKY. - "Catalogue of gravimetric stations in Latin America, Part I - Mexico, Texas & Central America". Geof. Int., v.6, n°3 & 4, 110 p, Mexico, 1966.
- 287 - WOOLLARD G.P. - J. MONGES CALDERA - J.C. ROSE & J.A. KOZLOSKY. - "Catalogue of gravimetric stations in Latin America, Part II - South America". Geof. Int., v.7, n°3 & 4, 120 p, Mexico, 1967.
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