

*This short form prospectus constitutes a public offering of these securities only in those jurisdictions where they may be lawfully offered for sale and therein only by persons permitted to sell such securities. No securities commission or similar authority in Canada has in any way passed upon the merits of the securities offered hereunder and any representation to the contrary is an offence. Information has been incorporated by reference in this short form prospectus from documents filed with securities commissions or similar authorities in Canada. Copies of the documents incorporated herein by reference may be obtained on request without charge from the Secretary, The Royal Bank of Canada, 1 Place Ville Marie, Montreal, Quebec, H3C 3A9, telephone (514) 874-6678.*

New Issue

September 18, 1984

**\$250,000,000**



# THE ROYAL BANK OF CANADA

## Floating Rate Debentures Due 2083

(unsecured and redeemable)

To be dated October 1, 1984

To mature October 1, 2083

Interest on the Floating Rate Debentures Due 2083 (the "Debentures") in respect of each month (an "Interest Period") will be payable on the first day of the following month. Such interest will accrue at a rate per annum equal to the sum of 0.40% plus the 30-day Bankers' Acceptance Rate reported by the Bank of Canada for the last Wednesday of the month preceding the Interest Period. Interest will be calculated on the basis of the actual number of days elapsed in each Interest Period divided by 365 or 366 in a leap year, as the case may be.

The Debentures will not be redeemable on or before October 1, 1989. Thereafter the Debentures will be redeemable at par, at the option of the Bank, on any interest payment date.

The Debentures will be direct unsecured obligations of the Bank, will rank equally with the Bank's other debentures and will be subordinate in right of payment to the claims of depositors and other unsubordinated creditors of the Bank as described under "Subordination".

**In the opinion of counsel the Debentures will qualify for investment under certain statutes as set out under "Eligibility for Investment".**

**Price: 100**

We, as principals, conditionally offer the Debentures, subject to prior sale, if, as and when issued by the Bank and accepted by us in accordance with the conditions contained in the underwriting agreement referred to under "Plan of Distribution", and subject to the approval of certain legal matters on behalf of the Bank by G. Harold Pickel, Associate General Counsel of the Bank and on our behalf by Ogilvy, Renault, Montreal.

	Price to public (1)	Underwriters' fee	Net proceeds to the Bank (1)(2)
Per unit .....	100.00%	1.05%	98.95%
Total .....	\$250,000,000	\$2,625,000	\$247,375,000

(1) Plus accrued interest, if any, from October 1, 1984 to the date of delivery.

(2) Before deducting expenses of the issue payable by the Bank estimated at \$75,000.

Subscriptions will be received subject to rejection or allotment in whole or in part and the right is reserved to close the subscription books at any time without notice. It is expected that the Debentures in definitive form will be available for delivery on October 1, 1984.

## Table of Contents

	Page
Eligibility for Investment .....	2
Documents Incorporated by Reference .....	2
Summary of the Offering .....	3
The Royal Bank of Canada .....	4
Application of Proceeds .....	4
Details of the Offering .....	4
Interest Coverage .....	6
Asset Coverage .....	6
Share and Loan Capital .....	7
Recent Developments .....	7
Plan of Distribution .....	7
Transfer Agent and Registrar .....	8
Purchaser's Statutory Rights .....	8
Certificates .....	9

### Eligibility for Investment

In the opinion of G. Harold Pickel, Associate General Counsel of the Bank and Ogilvy, Renault, the Debentures will, subject to general investment provisions, be eligible investments at the time of issue, without resort to the so-called "basket" provisions, for:

- (i) insurance companies regulated under the Canadian and British Insurance Companies Act (Canada), the Foreign Insurance Companies Act (Canada) and legislation of British Columbia, Alberta and Ontario governing insurance companies;
- (ii) loan companies regulated under the Loan Companies Act (Canada) and legislation of Ontario governing loan companies;
- (iii) trust companies regulated under the Trust Companies Act (Canada) and legislation of Alberta, Ontario and Quebec governing trust companies;
- (iv) pension funds regulated under the Pension Benefits Standards Act (Canada) and legislation of Alberta, Ontario and Quebec governing pension funds; and
- (v) a trust governed by a registered retirement savings plan or by a registered home ownership savings plan under the Income Tax Act (Canada).

In the opinion of such counsel, the provisions of An Act respecting Insurance (Quebec) would not preclude the investment by an insurance company in the Debentures, subject to the general investment provisions of that act.

### Documents Incorporated by Reference

The following documents, filed with the various securities commissions or similar authorities in each of the provinces of Canada, are specifically incorporated by reference and form an integral part of this short form prospectus:

- (a) Annual Information Form dated March 6, 1984;
- (b) Audited consolidated financial statements for the year ended October 31, 1983 together with the auditors' report thereon;
- (c) Management Proxy Circular dated November 7, 1983 in connection with the Bank's annual meeting of shareholders held on January 12, 1984; and
- (d) Unaudited interim financial statements for the fiscal quarters ended January 31, April 30 and July 31, 1984.

Any documents of the type referred to in the preceding paragraph and any notice of material change (excluding confidential reports) subsequently filed by the Bank with a securities commission or any similar authority in Canada, after the date of this short form prospectus and prior to the termination of the offering, shall be deemed to be incorporated by reference herein.

Any statement contained in a document incorporated or deemed to be incorporated by reference herein shall be deemed to be modified or superseded for purposes of this short form prospectus to the extent that a statement contained herein or in any other subsequently filed document which also is or is deemed to be incorporated by reference herein modifies or supersedes such statement. Any statement so modified or superseded shall not be deemed, except as so modified or superseded, to constitute a part of this short form prospectus.



## THE ROYAL BANK OF CANADA

### Summary of the Offering

<b>Issue:</b>	Floating Rate Debentures Due 2083 (the "Debentures").
<b>Amount:</b>	\$250,000,000
<b>Issue Price:</b>	100 plus accrued interest, if any.
<b>Maturity:</b>	October 1, 2083
<b>Delivery Date:</b>	October 1, 1984
<b>Floating Interest Rate:</b>	Interest on the Debentures in respect of each month (an "Interest Period") will be payable on the first day of the following month. Such interest will accrue at a rate per annum equal to the sum of 0.40% plus the 30-day Bankers' Acceptance Rate reported by the Bank of Canada for the last Wednesday of the month preceding the Interest Period. Interest will be calculated on the basis of the actual number of days elapsed in each Interest Period divided by 365 or 366 in a leap year, as the case may be.
<b>Redemption:</b>	The Debentures will not be redeemable on or before October 1, 1989. Thereafter, the Debentures will be redeemable at par, at the option of the Bank, on any interest payment date.
<b>Form and Denominations:</b>	The Debentures will be in fully registered form only, in denominations of \$100,000 and multiples thereof.
<b>Subordination:</b>	The Debentures will be direct unsecured obligations of the Bank ranking equally with the Bank's other bank debentures. The Debentures and all other bank debentures are subordinate in right of payment to the claims of depositors and other unsubordinated creditors of the Bank.
<b>Interest Coverage:</b>	Earnings for the 12 months ended July 31, 1984 available to meet interest on debentures were 5.1 times the interest requirements on all outstanding debentures including this issue.
<b>Asset Coverage:</b>	Adjusted net assets at July 31, 1984, available to cover debentures including this issue, were \$3,795 per \$1,000 principal amount of such debentures.
<b>Application of Proceeds:</b>	The net proceeds from this issue of Debentures will be added to the Bank's general funds and will be utilized for general banking purposes. The purpose of this issue is to enlarge the Bank's capital base.

*This is a summary only and is qualified by the more detailed information appearing elsewhere or incorporated by reference in this short form prospectus.*

## The Royal Bank of Canada

The Royal Bank of Canada (the "Bank") was chartered under the laws of the Province of Nova Scotia in 1869 and commenced operations in Halifax, Nova Scotia, in that year. Since 1871 the Bank has been a chartered bank under the Bank Act (Canada). The Bank's head office is located in The Royal Bank of Canada Building, 1 Place Ville Marie, Montreal, Quebec.

The Bank is the largest Canadian chartered bank and ranked fifth as at June 30, 1984 among North American banks in terms of total assets. In Canada, the Bank provides a full range of personal, commercial and corporate banking services in branches located in all the provinces and territories. The Bank conducts business on a global basis through approximately 100 foreign branches, representative offices and agencies and more than 100 subsidiaries and affiliates.

### Application of Proceeds

The net proceeds to the Bank from the sale of the Floating Rate Debentures Due 2083 (the "Debentures") offered hereby, after deducting estimated expenses of the issue and the underwriters' fee to be paid out of the general corporate funds of the Bank, will amount to \$247,300,000. Such proceeds will be added to the Bank's general funds and will be utilized for general banking purposes. The purpose of this issue is to enlarge the Bank's capital base.

### Details of the Offering

The following is a summary of the material attributes and characteristics of the Debentures offered hereby which does not purport to be complete. Reference is made to the Trust Indenture referred to below for the full text of such attributes and characteristics. Definitions of certain terms used in the Trust Indenture are set out hereunder.

#### *General*

The Debentures offered hereby will be issued under a trust indenture (the "Trust Indenture") to be dated as of October 1, 1984 between the Bank and Montreal Trust Company of Canada (the "Trustee") and will mature on October 1, 2083.

The Debentures will be issued in fully registered form only, in denominations of \$100,000 and multiples thereof. Interest on the Debentures will be payable in lawful money of Canada by cheque drawn on the Bank and sent by prepaid mail to the registered holder. Upon due notice to the Trustee, a registered holder will be entitled to have interest payments made to an account maintained by the registered holder at any financial institution in Canada that is a member of the Canadian Payments Association. Payment of the principal of the Debentures will be made against surrender of such Debentures at any branch of the Bank in Canada, at the option of the holder.

The Debentures will be direct unsecured obligations of the Bank ranking equally and rateably with all other debentures from time to time issued and outstanding under the Trust Indenture and all other bank debentures issued by the Bank. **The Debentures will not be insured deposits as defined by the Canada Deposit Insurance Corporation Act.**

Pursuant to the Bank Act the principal amount of the Debentures cannot be paid by the Bank at any time prior to October 2, 1989 except in the event of the insolvency or winding up of the Bank.

#### *Floating Interest Rate*

Interest on the Debentures in respect of each month (an "Interest Period") will be payable on the first day of the following month. Such interest will accrue at a rate per annum equal to the sum of 0.40% plus the 30-day Bankers' Acceptance Rate reported by the Bank of Canada in its weekly financial statistics for the last Wednesday of the month preceding the Interest Period. Interest will be calculated on the basis of the actual number of days elapsed in each Interest Period divided by 365 or 366 in a leap year, as the case may be.

If the applicable 30-day Bankers' Acceptance Rate is not available from the Bank of Canada, the 30-day Bankers' Acceptance Rate shall be deemed to be the average of mid-market quotations for 30-day bankers' acceptances of the Bank or, if not available, of at least two major Canadian Schedule A banks, obtained at 11:00 a.m. (Montreal time) on the last Wednesday of the month preceding the Interest Period from at least three Money Market Dealers chosen by the Bank.



If, in the reasonable judgment of the Bank, 30-day bankers' acceptances are no longer traded in Canada in a material way, the interest rate per annum will be equal to the sum of 0.50% plus the average of mid-market quotations for Government of Canada Treasury Bills maturing in or about 30 days from the date of quotation obtained at 11:00 a.m. (Montreal time) on the last Wednesday of the month preceding the applicable Interest Period from at least three Money Market Dealers chosen by the Bank.

### ***Redemption and Purchase***

The Debentures will not be redeemable by the Bank on or before October 1, 1989. Thereafter, the Debentures may be redeemed on any interest payment date, at the option of the Bank, prior to maturity in whole or in part on not more than 60 and not less than 30 days' prior notice at a price equal to 100% of the principal amount thereof plus, in each case, accrued and unpaid interest to the date fixed for redemption.

In the case of redemptions of less than all the Debentures, the Debentures to be redeemed will be selected by the Trustee by lot or in such other manner as the Trustee deems equitable.

After October 1, 1989 the Bank will have the right to purchase Debentures in the market or by tender or by private contract at prices not exceeding 100.50% of the principal amount thereof together, in all cases, with accrued and unpaid interest to the date of purchase and costs of purchase.

### ***Transfer***

Transfer of the Debentures may be effected on the books maintained by the Trustee for such purpose at the principal transfer offices of the Trustee in Halifax, Montreal, Toronto, Winnipeg, Regina, Calgary and Vancouver.

### ***Additional Debentures***

The Trust Indenture and the trust indenture dated April 15, 1971 and indentures supplemental thereto (the "1971 Trust Indenture") contain no restrictions on the amount of debentures which may be issued thereunder. The Bank Act however contains a restriction, the effect of which is that the Bank may not issue any debentures under the Trust Indenture or the 1971 Trust Indenture, or any other bank debentures, if as a result of such issue, the aggregate principal amount of the Bank's debentures outstanding with a stated maturity after the end of the financial year of the Bank in which the issue is made would exceed an amount equal to one-half of the total, at the time of the issue, of the paid-in capital, contributed surplus, retained earnings and general reserve of the Bank. Under this provision, as at July 31, 1984, the Bank was permitted to issue approximately \$720 million principal amount of debentures before giving effect to the issue of the Debentures offered hereby.

### ***Subordination***

Under the terms of the Trust Indenture, in the event of the insolvency or winding up of the Bank, the indebtedness evidenced by the Debentures and by all other debentures issued and outstanding under the Trust Indenture or the 1971 Trust Indenture is subordinate in right of payment to the prior payment in full of the deposit liabilities of the Bank and all other Indebtedness of the Bank other than Subordinated Indebtedness.

### ***Covenant***

The Trust Indenture will contain a covenant of the Bank to the effect that, so long as any Debentures are outstanding, the Bank will not create, incur or suffer to exist any Indebtedness, other than Subordinated Indebtedness, which shall be subordinate in right of payment to the prior payment of the deposit liabilities of the Bank.

### ***Definitions***

The Trust Indenture will contain, among others, definitions of terms used herein substantially as follows:

"Money Market Dealer" means a financial institution (excluding the Bank) designated by the Bank of Canada to conduct purchase and resale agreements of Government of Canada debt obligations with the Bank of Canada.

"Indebtedness" means

- (i) the deposit liabilities of the Bank at such time; and

- (ii) all other liabilities and obligations (other than any penalties as referred to in the Bank Act) of the Bank to third parties (other than shareholders of the Bank, as such) which would entitle such third parties to participate in a distribution of the Bank's assets in the event of the insolvency or winding up of the Bank.

"Subordinated Indebtedness" means

- (i) the liability of the Bank in respect of the principal of and premium, if any, and interest on the debentures issued under the Trust Indenture and the 1971 Trust Indenture;
- (ii) any Indebtedness which ranks equally with and not prior to the debentures issued under the Trust Indenture or the 1971 Trust Indenture in right of payment in the event of the insolvency or winding up of the Bank and which, pursuant to the terms of the instrument evidencing or creating the same, is expressed to be subordinate in right of payment to all Indebtedness to which the debentures issued under the Trust Indenture are subordinate in right of payment to at least the same extent as such debentures are made subordinate thereto; and
- (iii) any Indebtedness which ranks subordinate to and not equally with or prior to the debentures issued under the Trust Indenture or the 1971 Trust Indenture in right of payment in the event of the insolvency or winding up of the Bank and which, pursuant to the terms of the instrument evidencing or creating the same, is expressed to be subordinate in right of payment to all Indebtedness to which the debentures issued under the Trust Indenture are subordinate in right of payment to at least the same extent as such debentures are made subordinate thereto.

### Modification

The Trust Indenture provides that modifications and alterations of the Trust Indenture and of the debentures issued thereunder may be made if authorized by extraordinary resolution. The term "extraordinary resolution" is defined in the Trust Indenture to mean, in effect, a resolution passed by the affirmative vote of the holders of not less than two-thirds of the debentures affected by such modification or alteration represented and voted at a meeting of such debenture holders or an instrument or instruments in writing signed by the holders of not less than two-thirds of such debentures then outstanding. If any modification or alteration affects the rights of the holders of any series of debentures in a manner substantially different from that in which it affects the holders of other series, such extraordinary resolution must, in addition, be approved in a similar manner by the holders of the series of debentures so affected.

### Interest Coverage

After giving effect to this issue, the annual interest requirements on all debentures of the Bank outstanding as at July 31, 1984 (assuming for the Bank's two series of floating rate debentures an average prime rate of 13% and average 6 month LIBOR of 12.3125%, respectively and assuming for this issue a 30-day Bankers' Acceptance Rate of 12%, and assuming a conversion rate of Cdn. \$1.30 per U.S. \$1.00) will amount to \$149.7 million. Earnings of the Bank before the deduction of interest on debentures and income taxes for the twelve months ended July 31, 1984 amounted to \$765.6 million. This amount is approximately 5.1 times the total debenture interest requirements of \$149.7 million.

### Asset Coverage

As at July 31, 1984 and after giving effect to this issue the adjusted net assets of the Bank available to cover all debentures were as follows:

	July 31, 1984
	(in millions of dollars)
Total assets .....	\$87,981
Deduct: Deposit liabilities .....	\$77,150
Other liabilities .....	6,016
Income tax credit on Appropriations for Contingencies (1) .....	(9)
Net assets .....	83,157
Add: Net proceeds of this issue .....	247
Adjusted net assets available for debentures .....	<u>\$ 5,071</u>

(1) For purposes of calculating asset coverage an income tax credit has been recognized on the tax deductible portion of Appropriations for Contingencies to convert the entire amount of that account to a tax-paid basis.



The adjusted net assets of the Bank of \$5,071 million are equivalent to \$3,795 for each \$1,000 of the \$1,336 million principal amount of debentures outstanding as at July 31, 1984, after giving effect to this issue.

### Share and Loan Capital

Between October 31, 1983 and July 31, 1984, the Bank has issued an additional 3,508,578 common shares with an aggregate paid-in capital of \$108,045,030 pursuant to the Bank's Shareholder Dividend and Share Purchase Plan and as a result of debenture and preferred share conversions. On June 6, 1984 the Bank issued 1,000,000 Floating Rate First Preferred Shares Series C at a price of \$100 per share and 1,000,000 Floating Rate First Preferred Shares Series D at a price of U.S. \$100 per share. Such Floating Rate Preferred Shares are redeemable by the Bank after June 8, 1989, subject to the consent of the Inspector General of Banks. Such shares are not redeemable at the option of the holder. The net proceeds from the issue of such securities, after deducting estimated expenses of issue and the underwriting fee and assuming a conversion rate of \$1.30 per U.S. \$1.00, amounted to \$227,650,000. The following table sets out the share and loan capital of the Bank as at the respective dates:

	As at July 31, 1984	As at October 31, 1983
	(in thousands of dollars)	
Bank Debentures .....	\$1,085,765	\$1,119,413
Appropriations for Contingencies.....	113,197	100,197
Capital Stock .....	1,614,300	1,278,972
Retained Earnings .....	2,001,012	1,919,696

### Recent Developments

Net income for the nine months ended July 31, 1984 was \$344 million, 3% below the corresponding period of 1983. Return on assets for the period was 0.53%, one basis point lower than for the first nine months of 1983. Total assets were \$88.0 billion as at July 31, 1984 compared to \$84.7 billion as at October 31, 1983.

The loan loss provision charged to income for the nine months ended July 31, 1984 was \$402 million which is \$49 million or 14% higher than in the comparable period in 1983. This level reflects an estimate for full-year loan loss experience of \$696 million including a general provision for country lending. Although this figure is \$76 million or 10% lower than the loan loss experience reported in fiscal 1983, the application of the five-year averaging formula results in a higher loan loss provision charged to income in 1984 as compared to 1983.

Non-performing loans, i.e., those loans on which the accrual of interest has been discontinued due to doubts as to collectibility or where interest is more than 90 days past due, amounted to \$2.5 billion net of specific provisions for losses as at July 31, 1984. This amount which is down from the \$2.8 billion as at October 31, 1983 is basically unchanged since January 31, 1984.

### Plan of Distribution

Under an underwriting agreement dated September 18, 1984 between the Bank and Wood Gundy Inc., Dominion Securities Pitfield Limited, Nesbitt Thomson Bongard Inc., Burns Fry Limited and Lévesque, Beaubien Inc. (the "Underwriters"), the Bank has agreed to sell and the Underwriters have severally agreed to purchase on October 1, 1984 or such later date as may be agreed upon, but not later than October 18, 1984, subject to the terms and conditions stated therein, all but not less than all of the \$250,000,000 principal amount of Debentures at a price of \$100 per \$100 principal amount plus accrued interest, if any, from October 1, 1984 to the date of delivery, payable in cash to the Bank against delivery of such Debentures. The agreement provides that the Underwriters will be paid a fee of \$2,625,000 on account of services rendered in connection with the offering which fee will be paid out of the general funds of the Bank.

The obligations of the Underwriters under such agreement may be terminated at their discretion on the basis of their assessment of the state of the financial markets and may also be terminated on the occurrence of certain stated events. However, the Underwriters are obligated to take up and pay for all of the Debentures if any are purchased under the agreement.

In connection with this offering, the Underwriters may over-allot or effect transactions intended to stabilize or fix the market price of the Debentures at a higher level than the market price that would exist in a free market. These transactions may be begun or interrupted at any time during the distribution.

### **Transfer Agent and Registrar**

Montreal Trust Company of Canada at its principal transfer office in the cities of Halifax, Montreal, Toronto, Winnipeg, Regina, Calgary and Vancouver will be the transfer agent and registrar for the Debentures.

### **Purchaser's Statutory Rights**

Securities legislation in several of the provinces of Canada provides purchasers with the right to withdraw from an agreement to purchase the securities offered hereby within two business days after receipt, or deemed receipt, of this short form prospectus and any amendment. In several of the provinces, securities legislation further provides a purchaser with remedies for rescission or, in certain provinces, damages where the prospectus and any amendment contains a misrepresentation or is not delivered to the purchaser, but such remedies must be exercised by the purchaser within the time limit prescribed by the securities legislation of his province. Purchasers in Saskatchewan, as a term of this offering, are given the same rights of rescission and withdrawal as if it had been necessary to have had a prospectus and any amendment accepted by the Saskatchewan Securities Commission. The purchaser should refer to any applicable provisions of the securities legislation of his province for particulars of these rights or consult with a legal adviser.



## Certificates

Dated: September 18, 1984

The foregoing, together with the documents incorporated herein by reference, constitutes full, true and plain disclosure of all material facts relating to the securities offered by this short form prospectus as required by the securities laws of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and New Brunswick and, as required by the Securities Act (Quebec) and regulations thereunder, contains no misrepresentation that is likely to affect the value or the market price of the securities to be distributed.

(Signed) R. C. FRAZEE  
Chairman and Chief Executive Officer

(Signed) R. A. UTTING  
Vice-Chairman

(Signed) DOMINIC D'ALESSANDRO  
Senior Vice-President and Comptroller

(Signed) JOHN MERRIAM  
Chief Accountant

On behalf of the Board of Directors

(Signed) N. F. PHILLIPS  
Director

(Signed) C. A. DAGENAIS  
Director

To the best of our knowledge, information and belief, the foregoing, together with the documents incorporated herein by reference, constitutes full, true and plain disclosure of all material facts relating to the securities offered by this short form prospectus as required by the securities laws of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario and New Brunswick and, as required by the Securities Act (Quebec) and regulations thereunder, contains no misrepresentation that is likely to affect the value or the market price of the securities to be distributed.

Wood Gundy Inc.

By: (Signed) T. C. W. REID

Dominion Securities Pitfield Limited

Nesbitt Thomson Bongard Inc.

By: (Signed) L. H. GOTH

By: (Signed) D. M. McENTYRE

Burns Fry Limited

Lévesque, Beaubien Inc.

By: (Signed) JEAN A. ÉLIE

By: (Signed) PAUL A. POMMIER

The following includes the names of every person having an interest, either directly or indirectly, to the extent of not less than 5% in the capital of:

WOOD GUNDY INC.: Wood Gundy Inc. is a wholly-owned subsidiary of The Wood Gundy Corporation;

DOMINION SECURITIES PITFIELD LIMITED: None;

NESBITT THOMSON BONGARD INC.: J. B. Aune, B. J. Steck, G. R. P. Bongard, K. G. Copland, T. A. Jackson, K. W. McArthur and A. R. D. Nesbitt;

BURNS FRY LIMITED: H. B. Boyer, L. C. Burns, B. M. Cooper, R. J. Deyell, P. B. M. Eby, R. A. Gunn, D. K. Johnson, R. J. Lawrence, W. L. Matthews and F. J. Troop; and

LÉVESQUE, BEAUBIEN INC.: André Charron, Pierre Brunet, Paul A. Pommier, H. R. Marleau, Gustave Boudreault, Gaston Ostiguy, S. E. Brock and A. R. Graham.