



# **Allan MacLeod Cormack**

## **Scottish Ancestry South African Ingenuity American Opportunity**

by

**George Read, Nephew**

**Presented at:**

**Modern Challenges in Imaging**

**In the Footsteps of Allan MacLeod Cormack  
On the Fortieth Anniversary of his Nobel Prize**

**August 5-9, 2019**

**Tufts University Medford, Massachusetts**



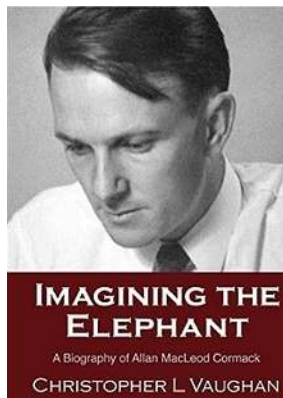
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Physicist

# Acknowledgements



Jean Cormack,  
Allan's daughter

Christopher "Kit"  
Vaughan and his  
biography of Allan



Todd Quinto & Tufts  
University for the  
opportunity to  
participate



For travel assistance



John Gurney & Mineral Services for  
the use of the diamond eclogite CT  
Scans





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# Scottish Ancestry

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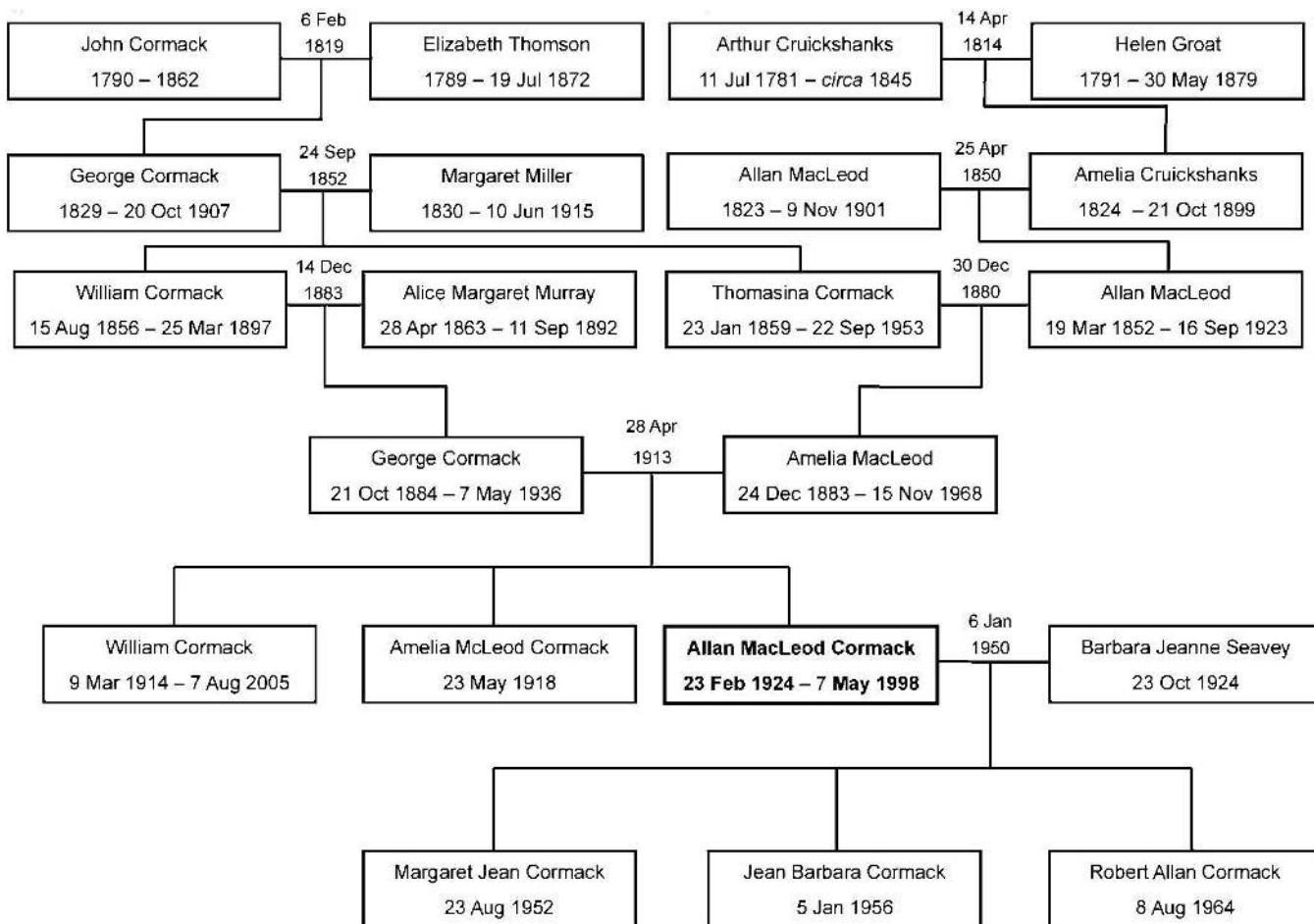






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# Scottish Ancestry







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# George & Margaret Cormack



George Cormack  
1829-1907  
Margaret Miller  
1830-1915





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# MacLeod Ancestors



Allan MacLeod  
1823-1901

Allan MacLeod  
1852-1923  
Thomasina Cormack  
1859-1953







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# George Cormack

George Cormack's home at 5 Harbour Quay, Wick







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# Amelia MacLeod

Amelia MacLeod's home at 15 Smith Terrace, Pulteney Town







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# John & Elizabeth MacLeod



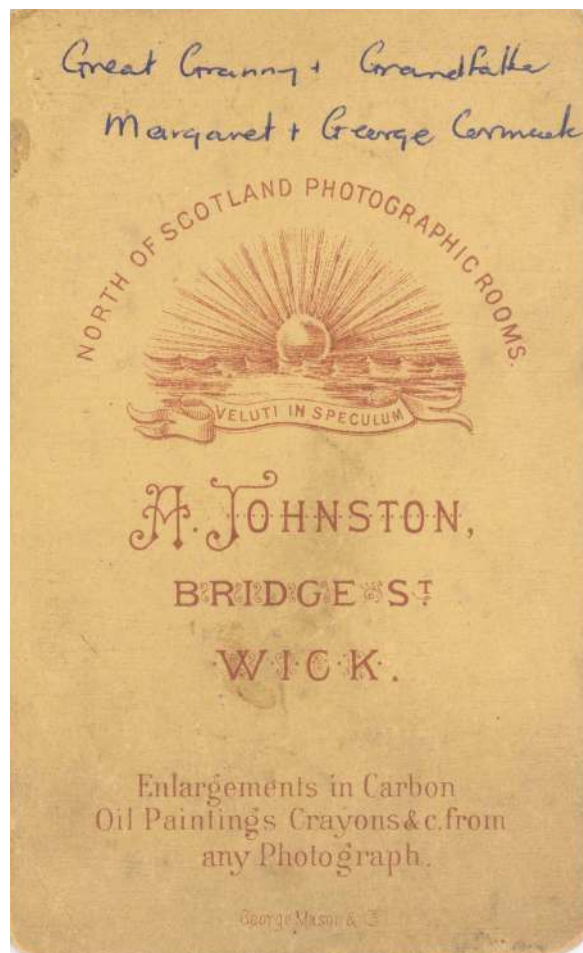
Home of John and Betty on South Road, Wick visited by George Read in June 1967





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## A. Johnston Wick Photographer



Three generations of the Johnston family operated a photographic studio in Wick from 1863 to 1975:

Alexander Johnston	1839-1896
William Johnston	1879-1950
Alexander Johnston	1909-2011







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# Wick Herring Fishing Boom

Pulteney Town Harbour 1886: Herring known as “Silver Darlings”  
In 1867 some 3,500 Herring Lassies gutted 50 million fish in 48 hours







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## George Cormack & Amelia MacLeod



George Cormack emigrates to  
Colony of Natal (South Africa)  
in 1903 as a telegraphist



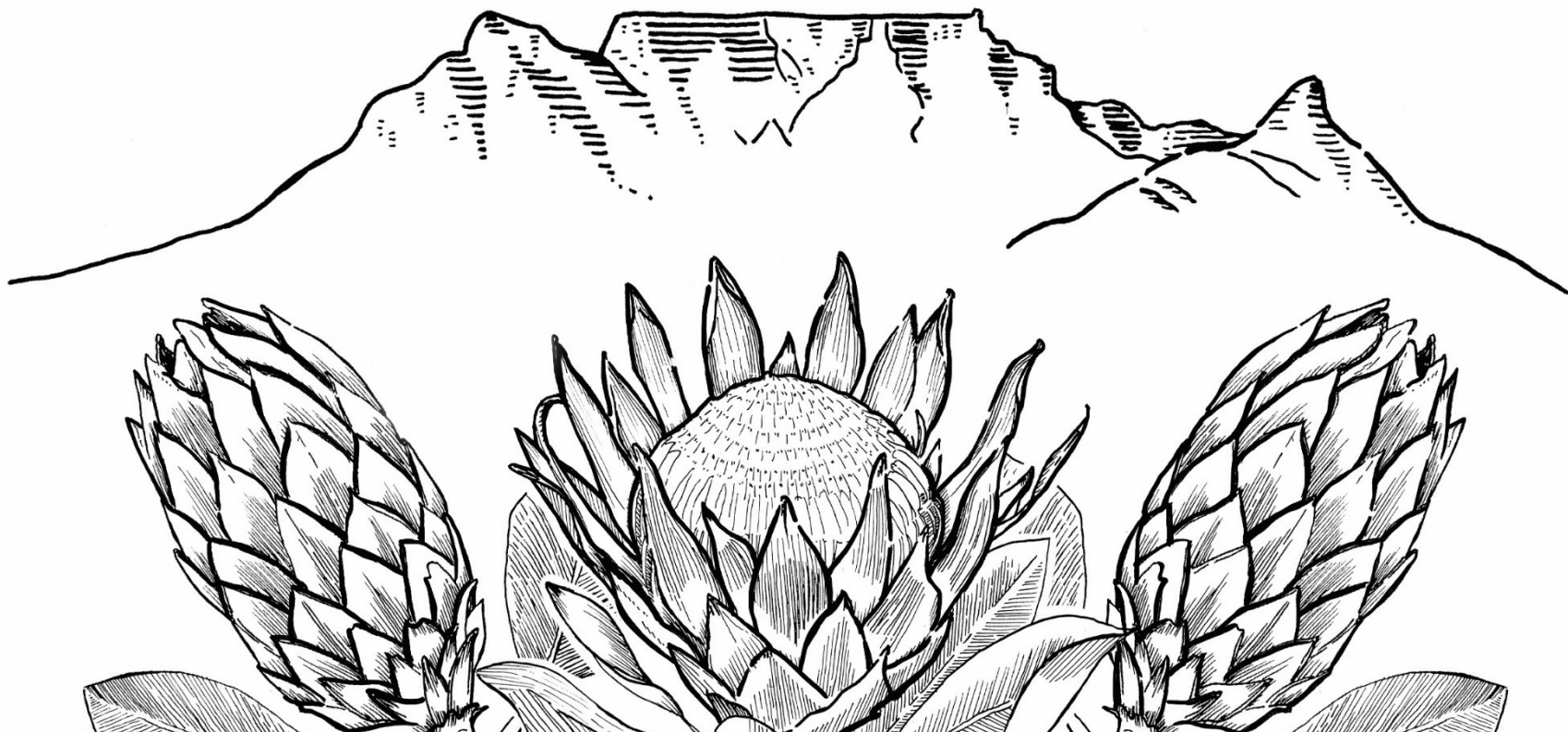
Amelia MacLeod trains as a school teacher  
at Moray House in Edinburgh. Follows  
George to South Africa in 1913





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# South African Ingenuity

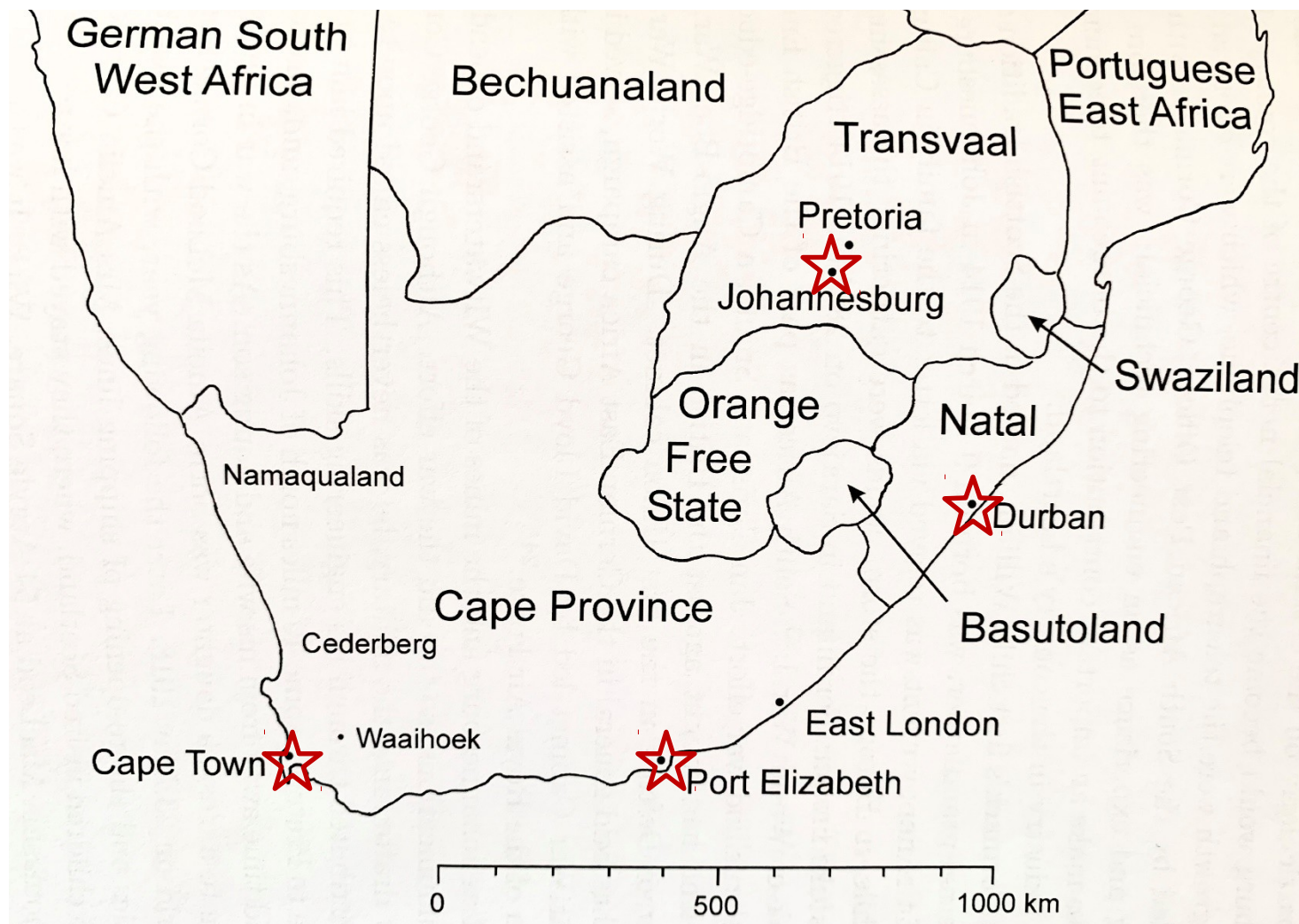






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# Union of South Africa 1910





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# Cormack Family 1926



The Cormack family on the beach at John O'Groats. They maintained close ties with their family in the north of Scotland





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# Cormack Family 1926



Allan was born in Johannesburg in 1924 and this was his first of many trips to his family roots in Scotland







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# Allan's Siblings 1930

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William Cormack  
1914-2005

Allan MacLeod Cormack  
1924-1998

Amelia MacLeod Cormack  
1918-2008





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# Allan's Siblings 1980



William Cormack  
1914-2005

Amelia MacLeod Cormack  
1918-2008

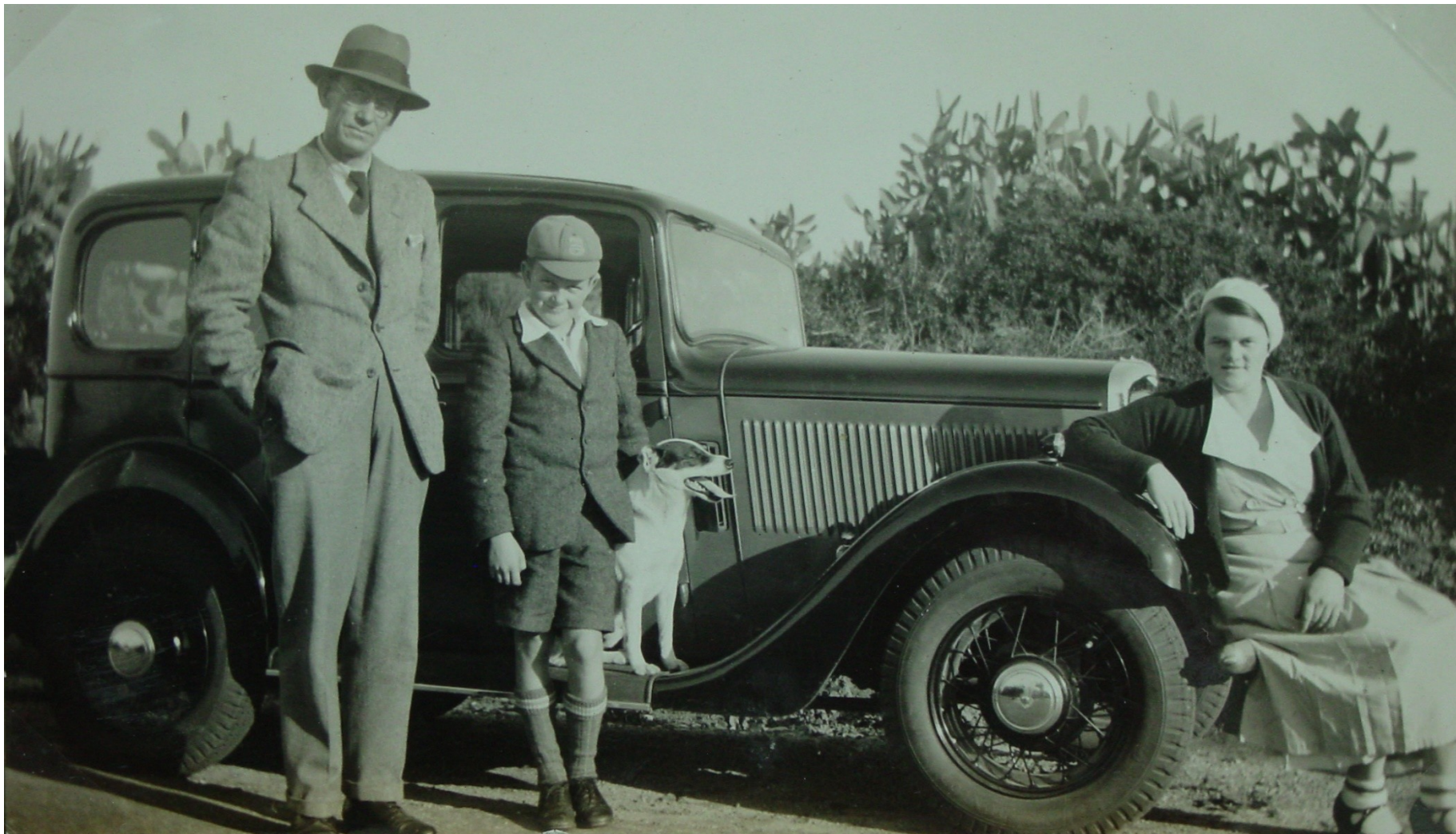
Allan MacLeod Cormack  
1924-1998





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# South African Travel 1935

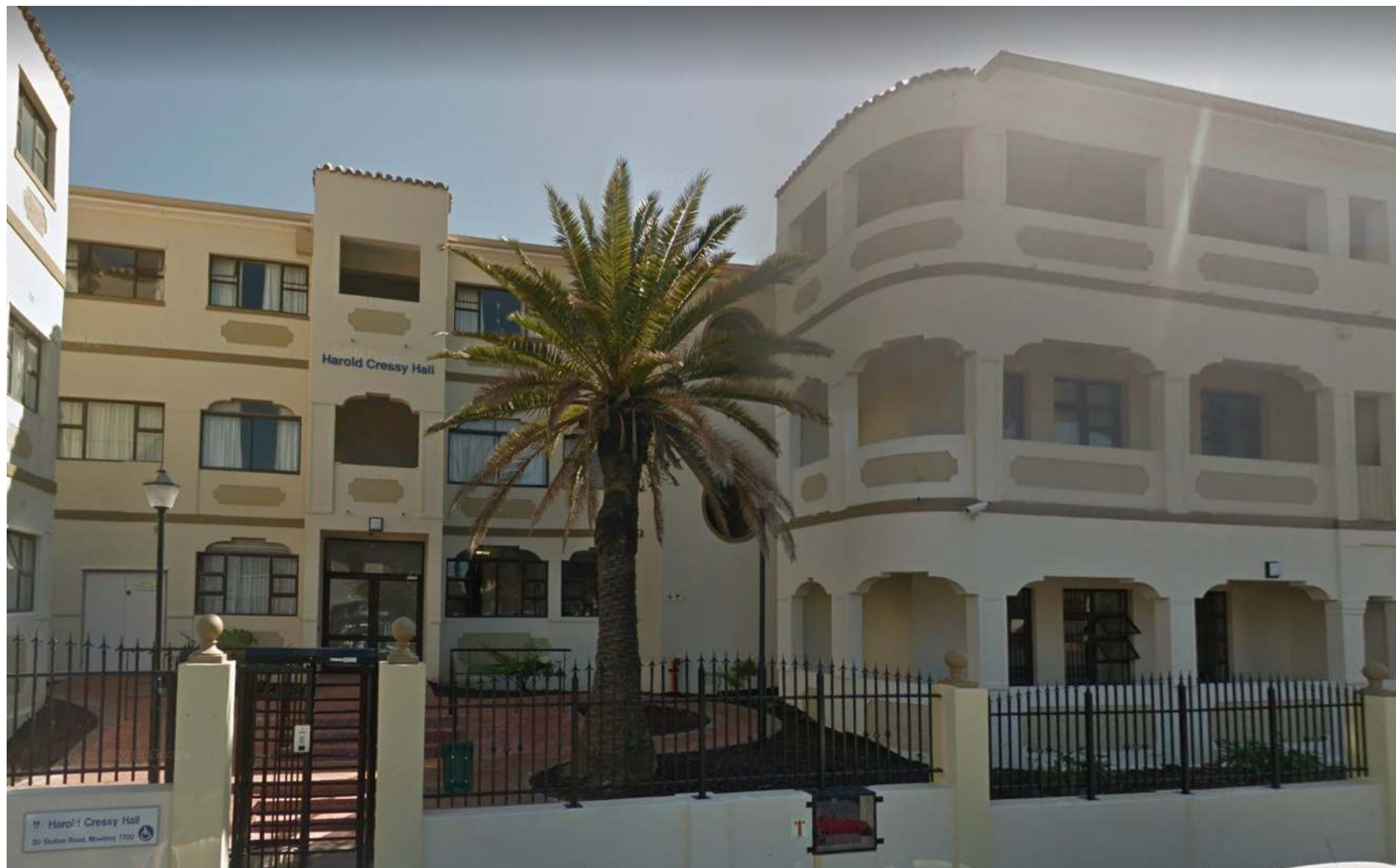






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# Mowbray Cape Town 1936





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# Rondebosch Boys High School



Allan's high school in Rondebosch, in the shadow of Table Mountain and Devils Peak. One stop on the suburban train line from their apartment in Mowbray.

At RBHS Allan received a solid grounding in Mathematics and Physics from excellent teachers.

Due to a hernia, Allan avoided rugby and cricket but became interested in rock climbing on Table Mountain which was in his backyard, so to speak!





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# Berlin Germany 1938



Allan with lion cubs in Berlin Zoo  
and at Sansouci Palace

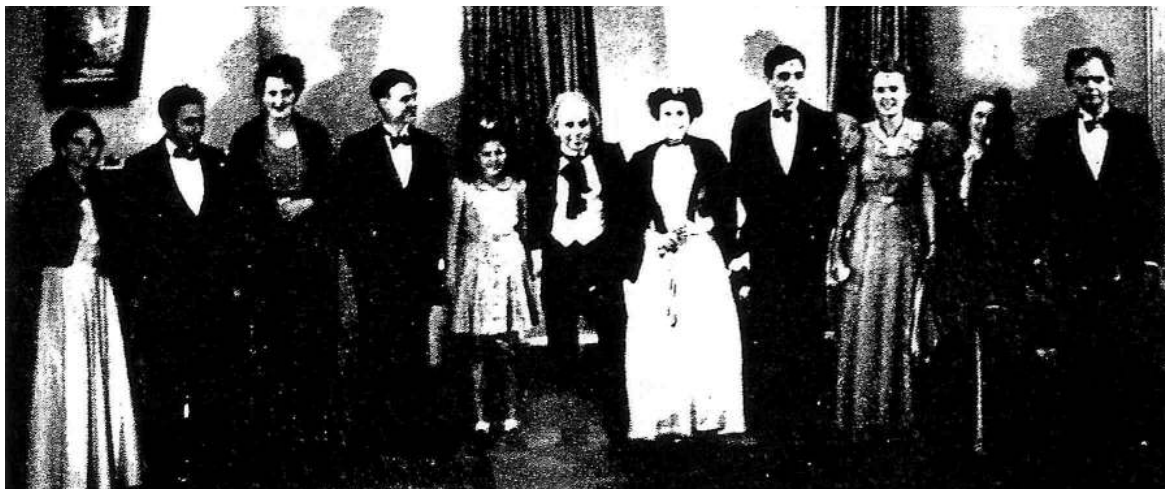
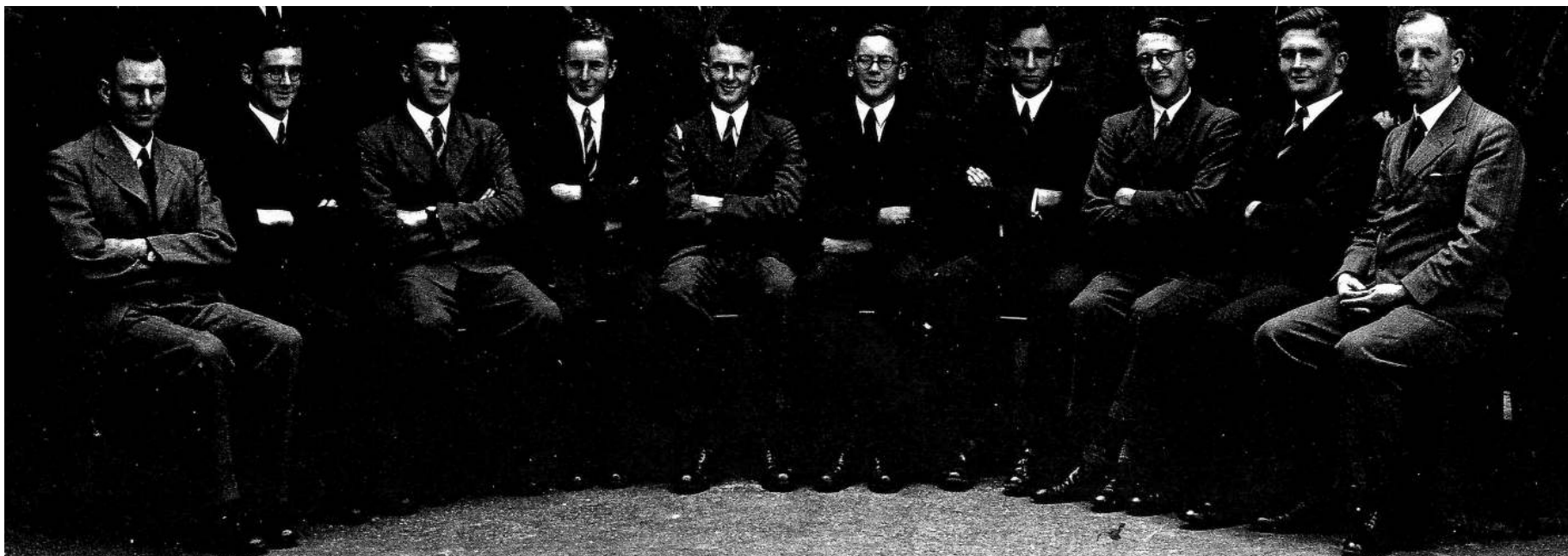






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# Rondebosch Boys High School



Allan was a participant in  
the Debating Society and  
dramatic productions:  
**Dear Brutus**  
This gave Allan confidence  
as a public speaker!





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# University of Cape Town 1942







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# UCT: BSc, MSc & Lecturer

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- 1942 first year registration to study Electrical Engineering, enjoyed the Applied Mathematics.
- 1943 second year continues with Electrical Engineering, participates in the Engineering and Scientific Society and introduced to the interface of Engineering and Geology.
- 1944 in third year Allan transfers to a Physics major and picks up a course in Chemistry. Graduates with a Physics major.
- 1945 Registers for a Masters in Physics and for his thesis studies the X-ray crystallography of nickel sulphides and silicates from the Insizwa layer complex in the Eastern Cape.
- 1946 Junior lecturer in Physics at UCT





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# UCT Physics: Prof R.W. James



*R. W. James*



RW James and Sir Lawrence Bragg at UCT, 1952

Reginald William James (1891-1964), a pioneer X-ray crystallographer of world-wide reputation, was Professor of Physics at the University of Cape Town from 1937 to 1956. Posthumously, he achieved a distinction which has come to few scientists anywhere: two of his ex-students from UCT won Nobel Prizes.







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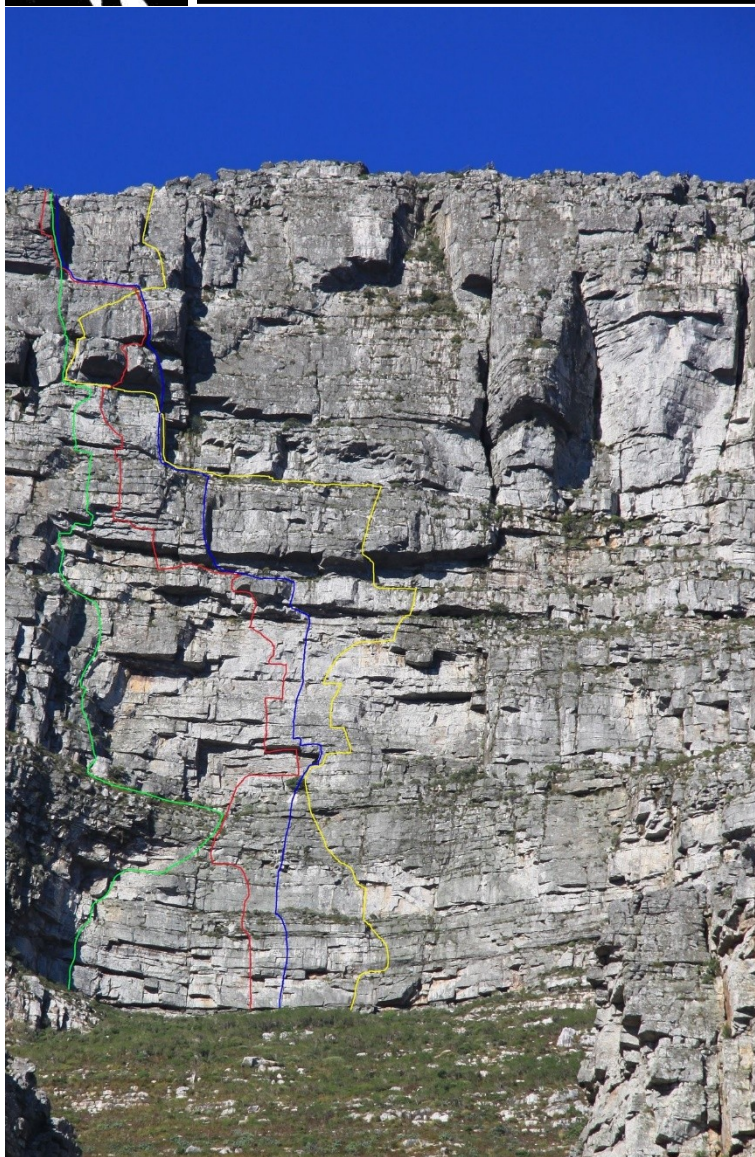
# UCTMSC: Waaihoek Hut





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# Aaron Klug on Africa Face



“I used to be a kind of Sunday climber, if you could put it in that way, doing mild climbs on Kloof Nek, B climbs, occasionally C climbs, and Allan was an established climber. I didn’t know that he had a route named after him, but he said he’d take me up something really interesting. I had done some climbing with ropes, but only a bit, just for short stretches, so he took me up Africa Face, which was a D or an E climb. About half way up, he was leading, above me, just the two of us. Suddenly I slipped off the ledge and swung out into the empty space and swung back again, hurting my arm. However, Allan held me, belayed the rope, pulled me up to safety and I was able to climb the rest of the way. I often think: What would have happened if he hadn’t been able to hold me?” Aaron Kluge Nobel Laureate 1982







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# Cederberg Wilderness Area







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# Cederberg Wolfberg Cracks







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# Cederberg Wolfberg Arch



San rock art near Stadsaal  
Rocks







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# Sneeuberg & Maltese Cross





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# Leaving Cape Town 1947



On the strength of his Master's degree, Allan was awarded a two-year fellowship for overseas study. With the support of Prof James, he was accepted at the Cavendish Laboratory at Cambridge

Amelia , Allan and Amy at Cape Town docks, before Allan's departure for England





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# Cavendish Laboratory 1947-1950

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- For over sixty years, up to the outbreak of WWII, the Cavendish Laboratory and its scientists had made extraordinary contributions to experimental physics, particularly in understanding the secrets of the atomic nucleus.
- Allan aimed to study nuclear physics at the Cavendish Laboratory, in particular the beta decay of Helium-six.
- However, the post WWII Cavendish was a different place and the cost nuclear research equipment was beyond the scale of a university in 1945.
- A group from the Dominions (Australia, Canada and South Africa) formed a secret society - The Nuclear Nit-Wits, which included: Allan Cormack, Godfrey Stafford, George Lindsey, Charlie Barnes and Joan Freeman







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# Cavendish Laboratory 1947-1950



Allan Cormack, Godfrey Stafford, George Lindsey

June Broomhead (Lindsey)





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# Cambridge: St Johns & Girton

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- Allan was accepted at St John's College and James Wordie was his tutor. Wordie was a geologist and Polar explorer, having been a participant in the Shackleton Expedition (1914-1917), among others.
- Barbara Seavey had completed an MA in Theoretical Physics at Radcliffe in 1948 and in September set sail for Southampton and Cambridge where she registered for the Mathematical Tripos Part III and was resident in Girton College, where she met Queen Elizabeth!
- Allan and Barbara met in Paul Dirac's class on Quantum Mechanics and in late 1948. After a St Johns and Girton party she stated: "I have met a fairly pleasant character by the name of Allan Cormack."
- Their relationship blossomed with walks, movies, music, reputable lectures attended together and trips to France
- Allan and Barbara were married in Boston on January 6, 1950





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# Cambridge: Barbara Seavey







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# Back to Cape Town 1950



I was one of the small third-year Physics class in 1952 which had the extraordinarily good fortune to be lectured to by both James and Cormack. An unforgettable combination they were, too: James a lecturer of outstanding clarity, shy and kindly, already an academic of stature, respected and revered by us all; Cormack lively and enthusiastic, amusing and irreverent, friendly and helpful.

ROBIN CHERRY Emeritus Professor of Physics, University of Cape Town. 24 May 1998





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# Uranium Prospecting 1954



Geiger tubes mounted on a Buick limo to prospect for uranium with American post graduate Geology student, in Namaqualand

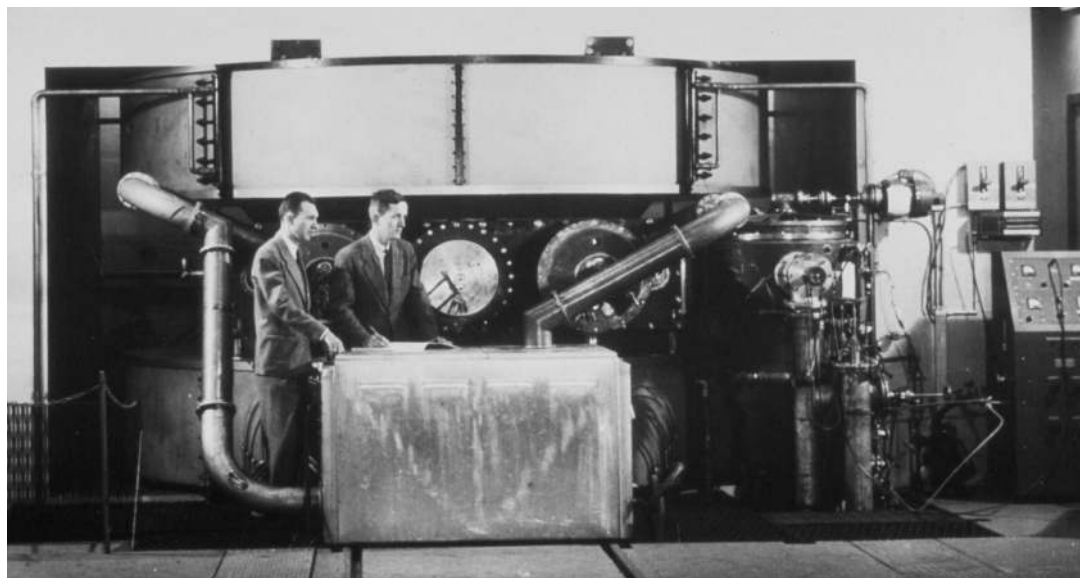




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# American Opportunity

- Sabbatical at Harvard Cyclotron Laboratory 1956 - Norman Ramsey
- 1957 Allan accepts position at Tufts University, where he remained until 1995



HARVARD  
UNIVERSITY



Tufts  
UNIVERSITY



Andreas (Andy) Kohler

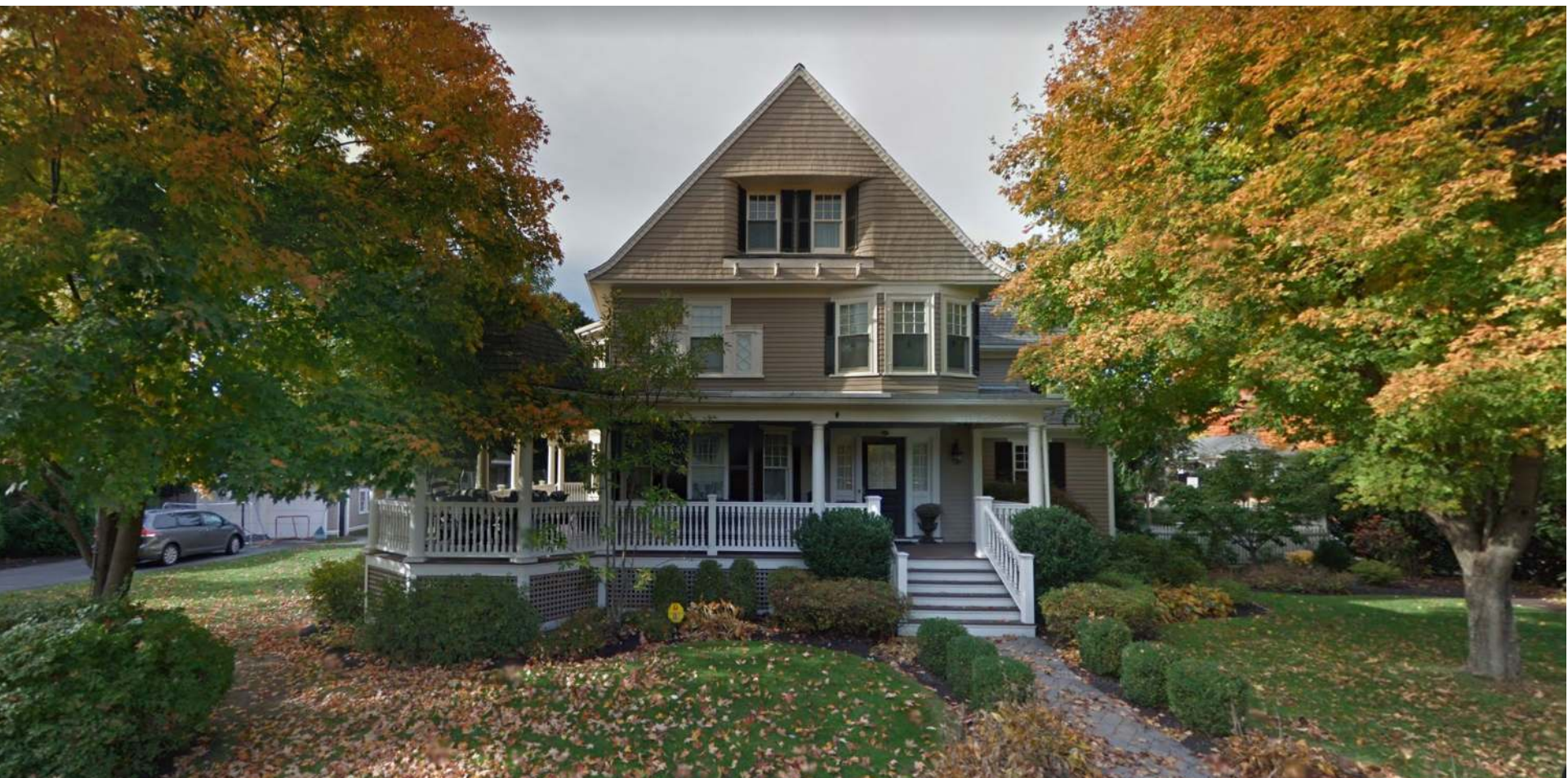




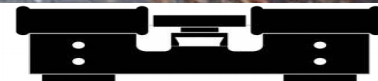


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# Cormack Home



Allan and Barbara Cormack's family home at 18 Harrison Street Winchester, MA





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# Cormack Family 1986

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Barbara, Allan, Margaret (1952), Robert (1964), Jean (1956)







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# Line Integral Papers 1963/4

Reprinted from JOURNAL OF APPLIED PHYSICS, Vol. 34, No. 9, 2722-2727, September 1963  
Copyright 1963 by the American Institute of Physics  
Printed in U. S. A.

## Representation of a Function by Its Line Integrals, with Some Radiological Applications

A. M. CORMACK

*Physics Department, Tufts University, Medford, Massachusetts*

(Received 28 January 1963; in final form 26 April 1963)

A method is given of finding a real function in a finite region of a plane given its line integrals along all straight lines intersecting the region. The solution found is applicable to three problems of interest for precise radiology and radiotherapy: (1) the determination of a variable x-ray absorption coefficient in two dimensions; (2) the determination of the distribution of positron annihilations when there is an inhomogeneous distribution of the positron emitter in matter; and (3) the determination of a variable density of matter with constant chemical composition, using the energy loss of charged particles in the matter.

Reprinted from JOURNAL OF APPLIED PHYSICS, Vol. 35, No. 10, 2908-2913, October 1964  
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## Representation of a Function by Its Line Integrals, with Some Radiological Applications. II

A. M. CORMACK

*Physics Department, Tufts University, Medford, Massachusetts*

(Received 13 April 1964)

A method is described for determining a variable gamma-ray absorption coefficient in a sample from measurements made outside the sample, and the applicability of the method to other radiological problems (e.g., positron scanning) is pointed out. An experimental test of the method is described, and it is concluded that the method works well.

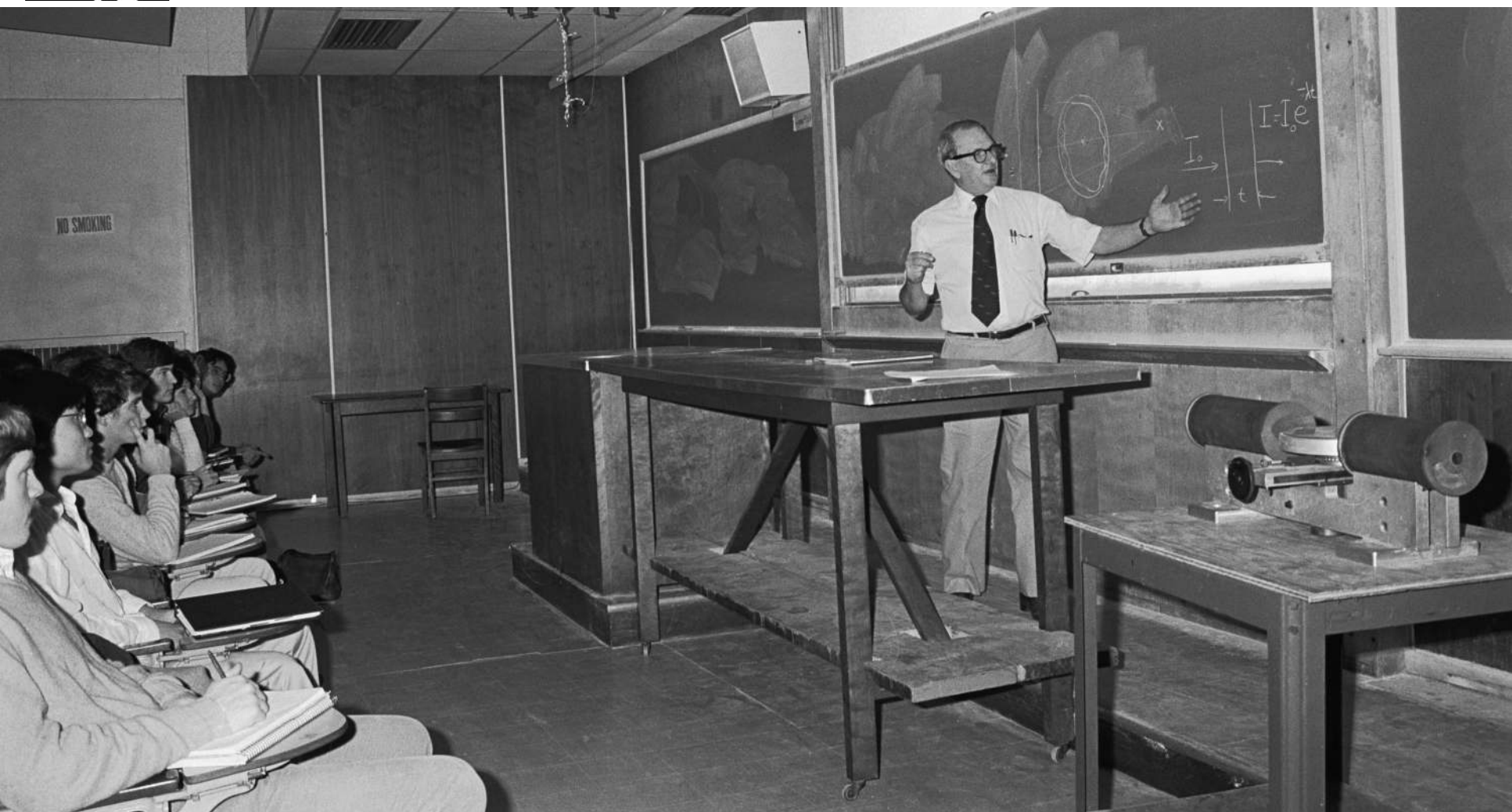






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# Allan & Freshman Physics Class





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# Nobel Prize 10 Dec 1979





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# Nobel Prize 10 Dec 1979

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“Your Majesties, Your Royal Highnesses, Ladies and Gentlemen, Godfrey Hounsfield has asked me to speak for both of us.....

There is irony in this award, since neither Hounsfield nor I is a physician. In fact it is not much of an exaggeration to say that what Hounsfield and I know about medicine and physiology could be written on a small prescription form!



While there is irony in the award, there is also hope that even in these days of increasing specialization there is a unity in the human experience, a unity clearly known to Alfred Nobel by the broad spectrum of his awards. I think that he would have been pleased to know that an engineer and a physicist, each in his own way, have contributed just a little to the advancement of medicine.”







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# Meeting Pope John Paul II 1983







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# Vatican Reception with Pope 1983







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# 90<sup>th</sup> Anniversary Nobel Prize 1991







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# Lindau Meetings



Allan enjoyed participation in the Lindau meetings arranged by Count Lennart Bernadotte, originally to promote science to assist in the recovery of post WWII Germany







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# Allan's Memorial June 1998



## Allan Cormack dies 7 May 1998

ORDER OF SERVICE  
Tuesday, June 30, 1998  
3:00 P. M.

PRELUDE

Joyce Galantic  
Organist

OPENING WORDS

Rev. Scotty McLennan  
University Chaplain

REMEMBRANCES

Kenneth Astill  
David Weaver  
Todd Quinto

MUSICAL INTERLUDE

REMEMBRANCES

Andreas Koehler  
Joseph Palmieri

MUSICAL INTERLUDE

REMEMBRANCES

Asger Aaboe  
George Read

CLOSING WORDS

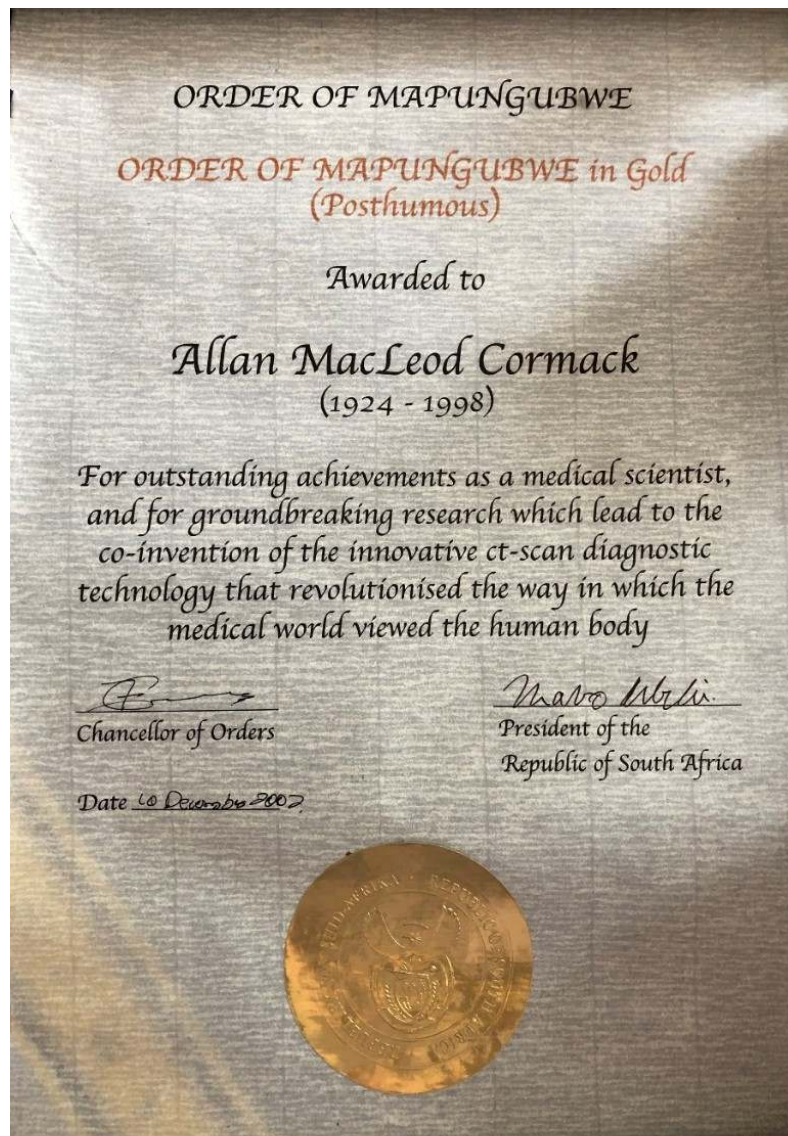
POSTLUDE





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# Order of Mapungubwe (Gold) 2002



- The Order of Mapungubwe is South Africa's highest honour. It was instituted on 6 December 2002, and is granted by the President, for achievements in the international area which have served South Africa's interests.
- The order is named after Mapungubwe, an ancient African nation which existed a thousand years ago in what is now the northern part of the Limpopo province.
- The first recipient of the order (in the Platinum class) was the late former president Nelson Mandela.







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# Order of Mapungubwe (Gold) 2002





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# Order of Mapungubwe (Gold) 2002







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# Intersection of our Worlds

- I have been a diamond exploration geologist since 1984
- Diamonds form at depth (High T & P) in the mantle and are transported rapidly to the surface by kimberlite volcanoes
- Diamonds occur in two types of mantle rocks: Peridotite and Eclogite
- The genesis of diamond in these two rock types is the subject of extensive debate
- Recent high-resolution CT Scanning provides insights into diamond genesis

11<sup>th</sup> International Kimberlite Conference Extended Abstract No. 11IKC-4463, 2017



## Metasomatic diamond formation revealed by X-Ray CT scanning of diamondiferous eclogites from southern Africa

**J. J. Gurney<sup>1,2</sup>, R. L. Kahle<sup>2</sup>, B. Kahle<sup>2</sup>, S. H. Richardson<sup>2</sup>, A. du Plessis<sup>3</sup>**

1. Mineral Services, 42 Morningside, N'dabeni, Cape Town 7701, [john.gurney@msgroup.net](mailto:john.gurney@msgroup.net)

2. Department of Geological Sciences, University of Cape Town, Rondebosch, Cape Town 7701

55 3. CT Scanner Facility, Stellenbosch University, PO Sauer Building, Bosman Road, Stellenbosch 7602





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# CT Scans of Diamond Eclogites

Ex22



Width 22mm

Ex23



Width 30 mm

Diamond eclogite xenoliths from Excelsior/Ardo Mine near Kimberley, SA

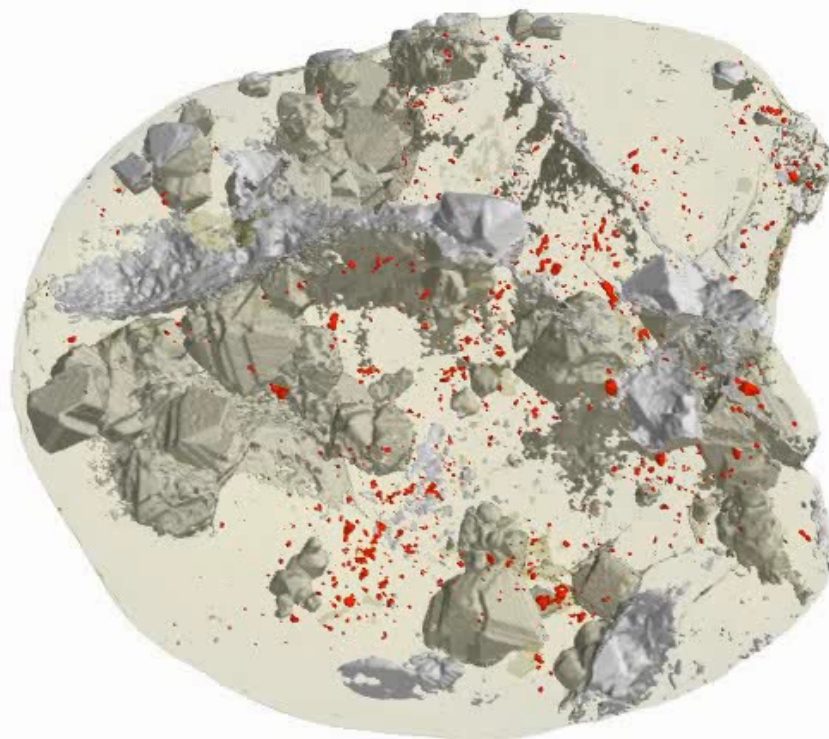






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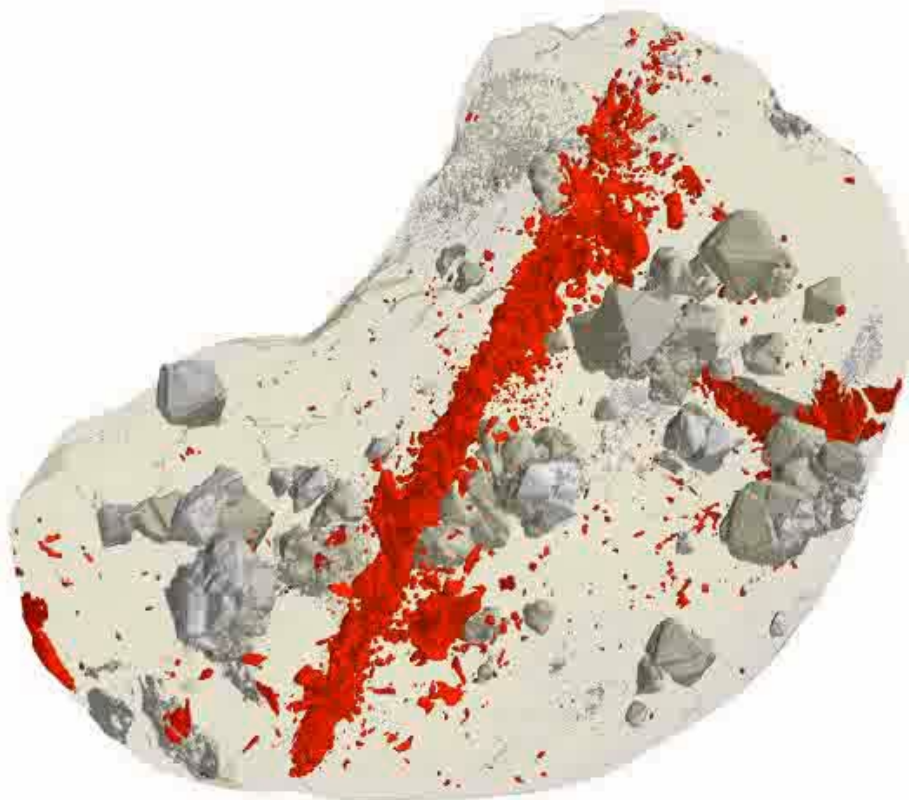
# Eclogite E22





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# Eclogite Ex23







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# Eclogite CT Scan Conclusions

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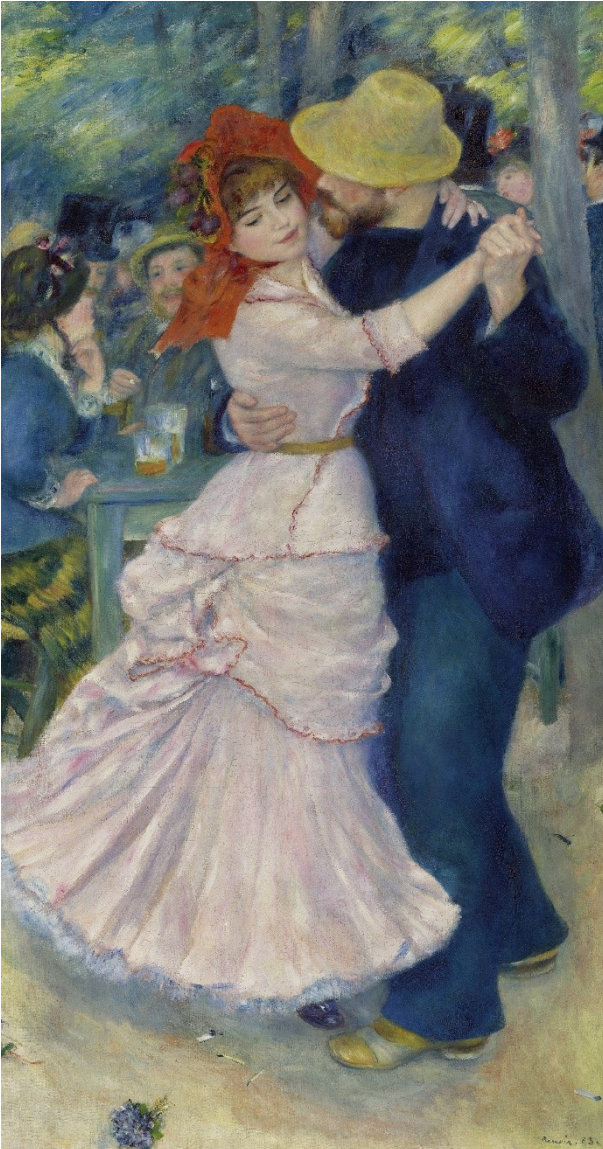
- **Diamonds in eclogite are frequently found associated with fluid pathways in the host rock.**
- **The diamonds can be major constituents of certain metasomatic veins.**
- **The host eclogite is older than the infiltrating metasomatic fluid and the diamond.**
- **There can be more than one diamond forming event in the same host eclogite.**
- **Crystallisation from small volume metasomatic fluids is accompanied by dis-equilibrium between newly formed phases.**





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# In Conclusion



- Allan was a very meticulous but free-thinking scientist - this drove his creativity
- Allan liked adventure, stimulating conversation, music, dance and art
- While Allan became a great scientist, he maintained his humility and was willing to share his ideas, particularly with young scientists
- May our memories of Allan inspire our future







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# Thank You

