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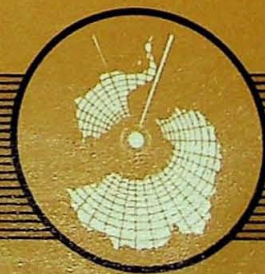
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## K-Ar Ages of the Winkel Point Formation (Fildes Peninsula Group) and Associated Intrusions, King George Island, Antarctica

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### ABSTRACT

*This paper presents four new K-Ar ages carried out on whole-rock samples of the Winkel Point Formation (olivine basalts, basaltic-andesites and andesites belonging to the Fildes Peninsula Group). Two K-Ar ages of associated andesitic plug and dyke (supposedly equivalents to the Admiralty Bay Group) are also discussed.*

*Those results suggest the Middle-Late Paleocene age to the lava flows that crop out in the central-northern region of the Fildes Peninsula, King George Island, followed by an intrusive magmatic episode related to the Early Eocene.*

Key words: Andesites, basalts, geochronology, volcanism.

## Edades K-Ar de la Formación Punta Winkel (Grupo Península Fildes) e intrusiones asociadas isla Rey Jorge, Antártica

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### RESUMEN

*Este trabajo presenta 4 edades K-Ar en roca-total obtenidas en basaltos de olivina, basaltos andesíticos y andesitas provenientes de la Formación Winkel Point (Grupo Península Fildes) y una en un "plug" y otra de un dique andesítico, supuestamente equivalentes al Grupo Admiralty Bay, que afloran en la región centro-norte de la península Fildes, isla Rey Jorge.*

*Estos resultados sugieren una edad Paleocénica Media a Superior para los derrames que componen la Formación Winkel Point, seguidos de un episodio magmático intrusivo relativo al Eoceno Superior.*

Palabras claves: Andesitas, basaltos, geocronología, volcanismo.

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## INTRODUCTION

In this work we report four new K-Ar ages carried out on whole-rock samples of the Winkel Point Formation (Fensterseifer *et al.*, in press), a volcanic-sedimentary lithostratigraphic unit that belongs to the Fildes Peninsula Group (Hawkes, 1961) and crops out in the south-western portion of the King George Island (Fig. 1). Two K-Ar ages of associated subvolcanic bodies are also discussed.

The samples for isotope studies were collected during the 2nd to 5th Brazilian Antarctic Expeditions, between 1984 and 1987, and had been analysed at the Geochronological Research Center of the Institute of Geosciences, University of São Paulo, Brazil.

### The Winkel Point Formation and associated intrusions in the regional geologic context

The Fildes Peninsula Group (Hawkes, *op. cit.*) is composed by a thick succession of lava flows of different compositions (from basalts to andesites) intercalated with volcanoclastic rocks. Intense weathering at the surface of several lava flows, the presence of plant remains associated to the volcanoclastic (fragments of fossil wood) or to lacustrine sedimentites (impressions of leaves), as well as its character and structure of lava flows, strongly suggest a subaerial generation for the volcanics. Moreover, the unit has been interpreted as a stratocone complex composed mainly by ejected materials issued from distinct effusive centers, partially overlapping one another.

The Fildes Peninsula Group overlies rocks of an unknown basement and has been divided into four minor lithostratigraphic units: the Clement Hill, Fildes Strait, Schneider Bay and Winkel Point formations (Fensterseifer *et al.*, *op. cit.*, Fig. 2). The geological contacts between them are important regional faults associated to a complicated structural pattern of grabens and horsts.

The Winkel Point Formation is the youngest unit of the proposed stratigraphic column and crops out in the central-northern region of the Fildes Peninsula (Fig. 2). It represents a volcanic-sedimentary succession composed by porphyritic-olivine-basalts, basaltic andesites and andesites with intercalations of lapilli-tuffs and epiclastic rocks. Impressions of leaves can be found in siltic beds.

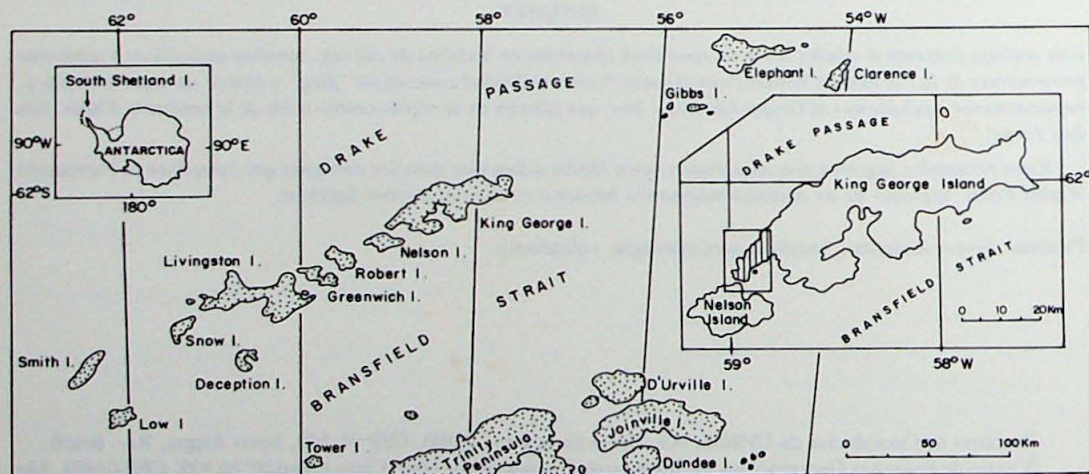


Fig. 1. Key map to show location of King George Island in the South Shetland Island and the Fildes Peninsula region (INSET).



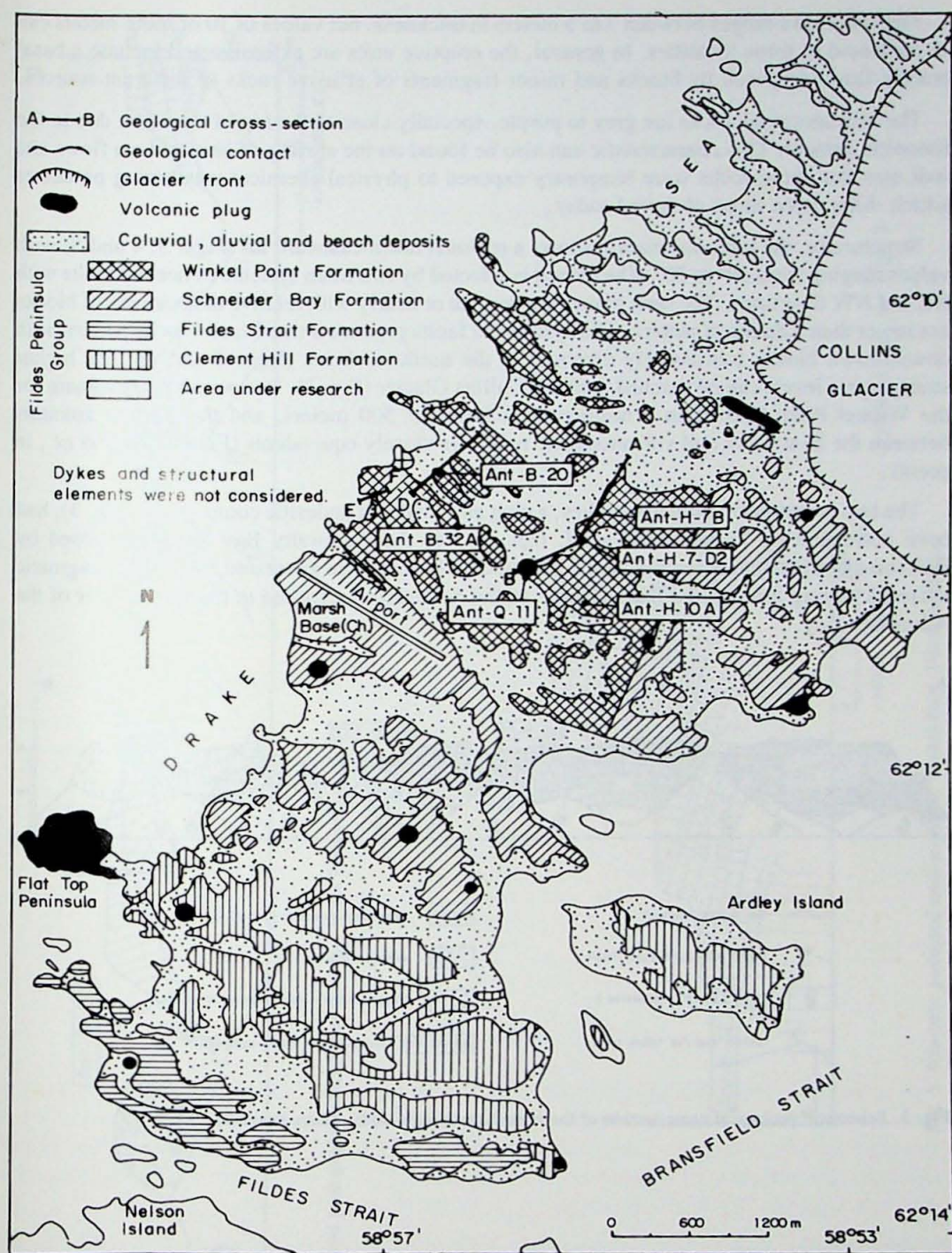


Fig. 2. Schematic geological map of Fildes Peninsula with location of dated samples.



The lava flows ranges between 3 to 6 meters in thickness, but values of 10 or more meters can be measured in some localities. In general, the eruptive units are extensive and include a basal breccia flow composed by blocks and minor fragments of effusive rocks of different sources.

The volcanoclastic rocks are grey to purple, specially close to the top of the beds, due to the limonitic cement. This characteristic can also be found on the surface of several lava flows and indicates that these rocks were temporary exposed to physical-chemical weathering processes which differ from those observed today.

Structurally, the rock association shows a regional north-eastward tilt (Figs. 3, 4 and 5) with values ranging from  $10^{\circ}$  to  $30^{\circ}$ . The terrain is affected by two main systems of normal faults with NE and NW directions. The fault planes are vertical or nearly vertical with relative dislocations of blocks not larger than a dozen of meters. The systems of faults produce a tilted fault blocks pattern with downthrown blocks successively disposed to the north-northeast (Figs. 3 and 4). The higher stratigraphic levels can be reached near the Collins Glacier (Fig. 2). It is possible to estimate for the Winkel Point Formation a minimum thickness of 500 meters, and the relative amounts between the lava flows and volcanoclastic rocks are closely equivalents (Fensterseifer *et al.*, in press).

The two investigated intrusive bodies, a plug and a dyke of andesitic composition (Fig. 3), had been correlated by Fensterseifer *et al.* (*op. cit.*) to the Admiralty Bay Group proposed by Birkenmajer (1980) to assemble all the plutonic rocks that were generated by distinct magmatic episodes cutting through the King George Island Supergroup exposed in the west border of the Admiralty Bay.

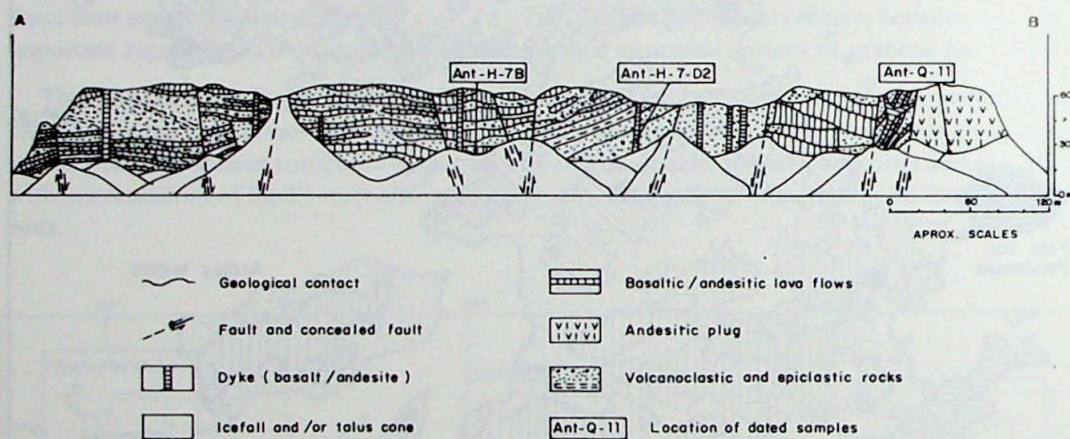


Fig. 3. Schematic geological cross-section of the central-north high lands, Fildes Peninsula.



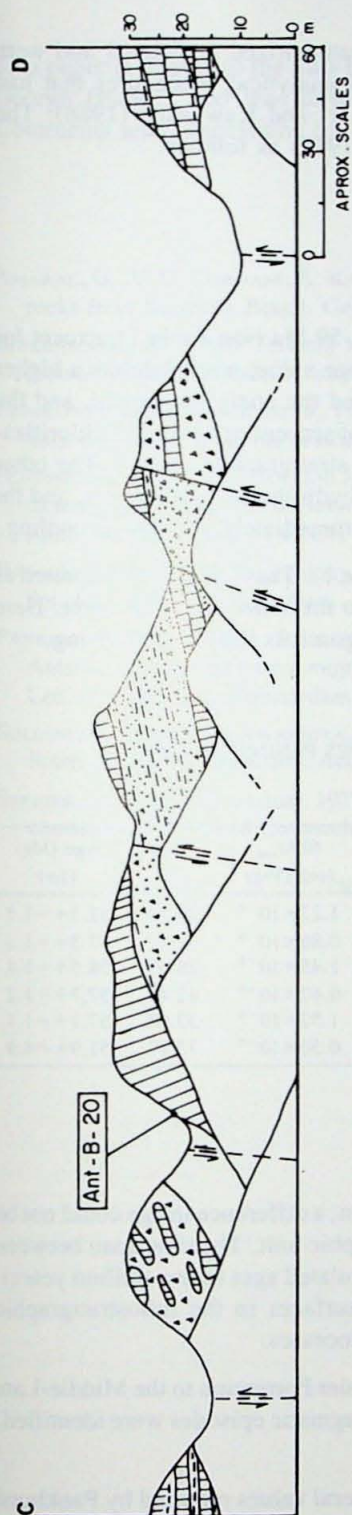


Fig. 4. Schematic geological cross-section at Skua bay, Fildes Peninsula.

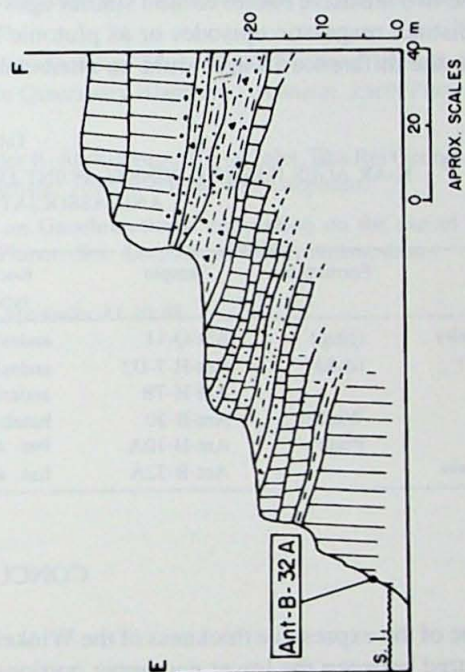


Fig. 5. Schematic geological cross-section at Winkel Point, Fildes Peninsula.

— Symbols as in fig. 3 —



## Geochronological results

The K-Ar data obtained for the Winkel Point Formation are summarized in Table 1 and were carried out on whole-rock samples according to the standard analytical procedures that had already been described by Amaral *et al.* (1966) and Soliani Jr. and Kawashita (1986). The constants used are those recommended by Steiger and Jäger (1977) as follows:

$$\lambda_{40K} = 4.962 \times 10^{-10} \text{ a}^{-1}$$

$$\lambda_{40K_{\text{tot}}} = 0.581 \times 10^{-10} \text{ a}^{-1}$$

$$(40\text{Ar}/36\text{Ar})_{\text{atm}} = 295.5$$

$$40K = 0.01167 K_{\text{tot}}$$

The measured ages for the lava flows are similar, around 57-59 Ma (see Table 1), except for Ant-B-32A whose apparent age is  $51.9 \pm 4.9$  Ma. This lower age value, which exhibits a higher analytical error, could be caused by weathering, which affected the analysed sample, and the obtained age must be taken as minimum. In spite of evidences of serpentinization and chloritization, this sample has been chosen by its lower position in the stratigraphic column. The other samples are well preserved without evidence of weathering or hydrothermal alterations, and the ages of about 58 Ma may be related to their crystallization and immediately subsequent cooling.

The two intrusive bodies exhibit similar ages ca. 50 Ma (Table 1). They could be interpreted as two distinct magmatic episodes or as plutonic bodies related to the same intrusive event. Here again, the difference in age could be attributable to partial argon loss due to weathering.

Table 1  
K-AR AGES FOR THE WINKEL POINT FORMATION, FILDES PENINSULA GROUP,  
AND ASSOCIATED INTRUSIONS:

Group	Formation	Sample	Rock type	%K	$40\text{Ar}_{\text{rad}}$ (ccSTP/g)	$\text{Ar}_{\text{atm}}$ (%)	Age (Ma) (1 $\sigma$ )
Admiralty	(plug)	Ant-Q-11	andesite	0.6150	$1.27 \times 10^{-6}$	36.33	$52.3 \pm 1.3$
Bay (?)	(dyke)	Ant-H-7-D2	andesite	0.4605	$0.86 \times 10^{-6}$	52.17	$47.5 \pm 1.3$
Fildes		Ant-H-7B	andesite	0.6273	$1.45 \times 10^{-6}$	28.09	$58.5 \pm 1.4$
	Winkel	Ant-B-20	basalt	0.2960	$0.67 \times 10^{-6}$	42.46	$57.7 \pm 1.2$
	Point	Ant-H-10A	bas. andes.	0.6728	$1.52 \times 10^{-6}$	33.68	$57.1 \pm 1.1$
Peninsula		Ant-B-32A	bas. andes.	0.2458	$0.50 \times 10^{-6}$	77.97	$51.9 \pm 4.9$

## CONCLUSIONS

In spite of the expressive thickness of the Winkel Point Formation, a difference in age could not be measured between the lower and upper portions of the stratigraphic unit. The time span between them is probably of the same magnitude as the errors for the calculated ages (a few million years), although the presence of meteorized beds at the lava flow surfaces in the lithostratigraphic complex suggests important interruptions of the generation processes.

Based on the present data, it is possible to refer the Winkel Point Formation to the Middle-Late Paleocene. In addition, at least one, and maybe two intrusive magmatic episodes were identified, related to the Early Eocene.

All the K-Ar results here included are in agreement with several values reported by Pankhurst and Smellie (1983) for samples attributed to the northern region of the Fildes Peninsula, and are also in accordance with the paleobotanical studies carried out by Czajkowski and Rösler (1986).



## ACKNOWLEDGMENTS

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