

# OCCUPATIONAL RADIATION DOSES OF UNITED KINGDOM HIGH ALTITUDE MOUNTAIN GUIDES AS A RESULT OF COSMIC RAY EXPOSURES.



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## 1. Introduction

United Kingdom (UK) based professional mountain guides receive radiation doses from ultraviolet radiation (UVR) and cosmic rays during air travel and their time spent at elevated altitudes in the mountains of the world. These radiation doses are received as part of their employment. This paper examines these occupational cosmic radiation exposures and raises some issues for further consideration.

## 2. Seven summits

The term "seven summits" [1] refers to the highest mountain on each of the Earth's seven continental plates. Their locations are illustrated in the map on this poster. Guides often take clients up the seven summits and receive a greater cosmic radiation exposure through the delivery of their work than they would have received by doing guiding work in the much lower altitude mountains of the UK.

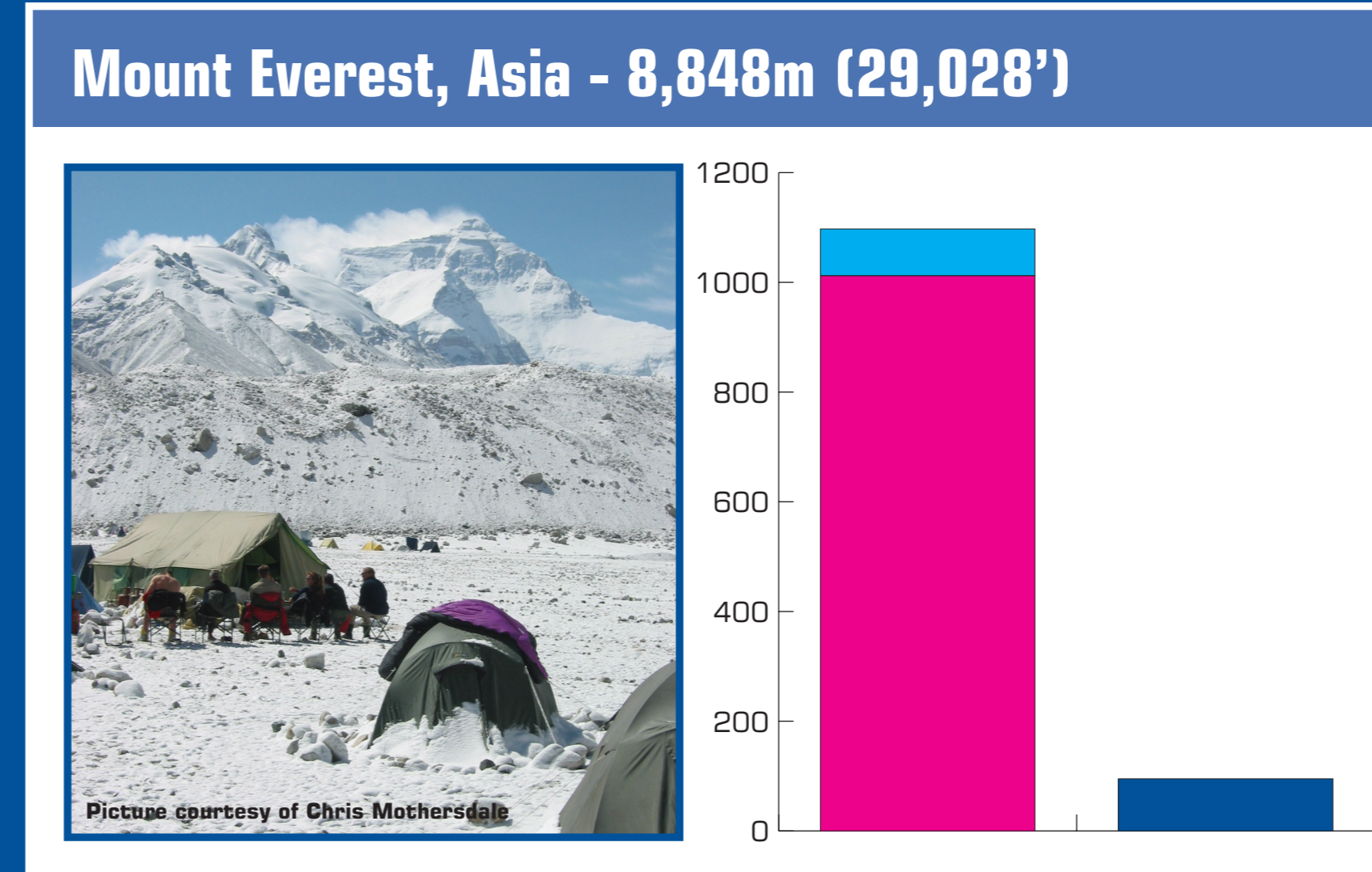
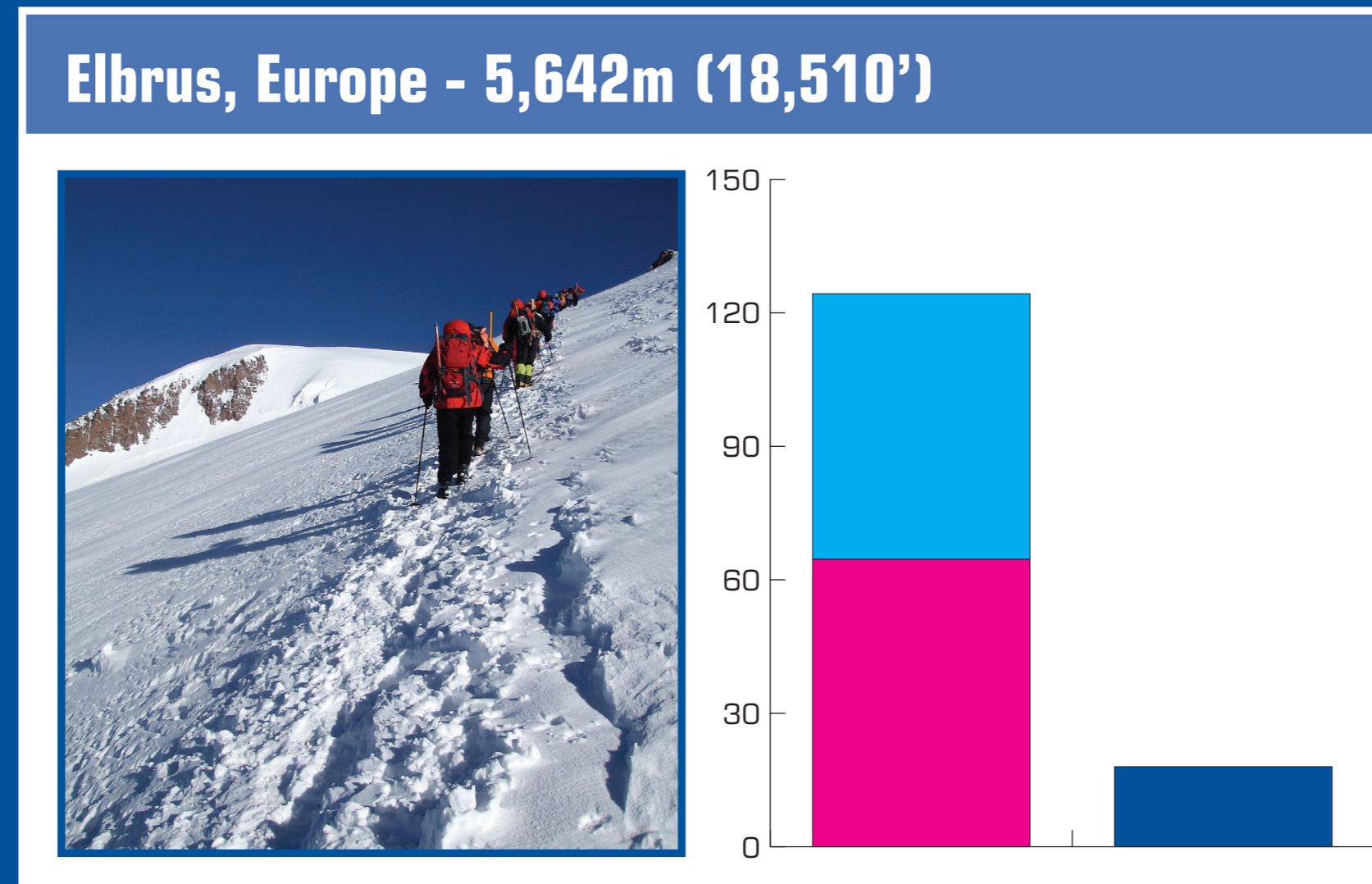
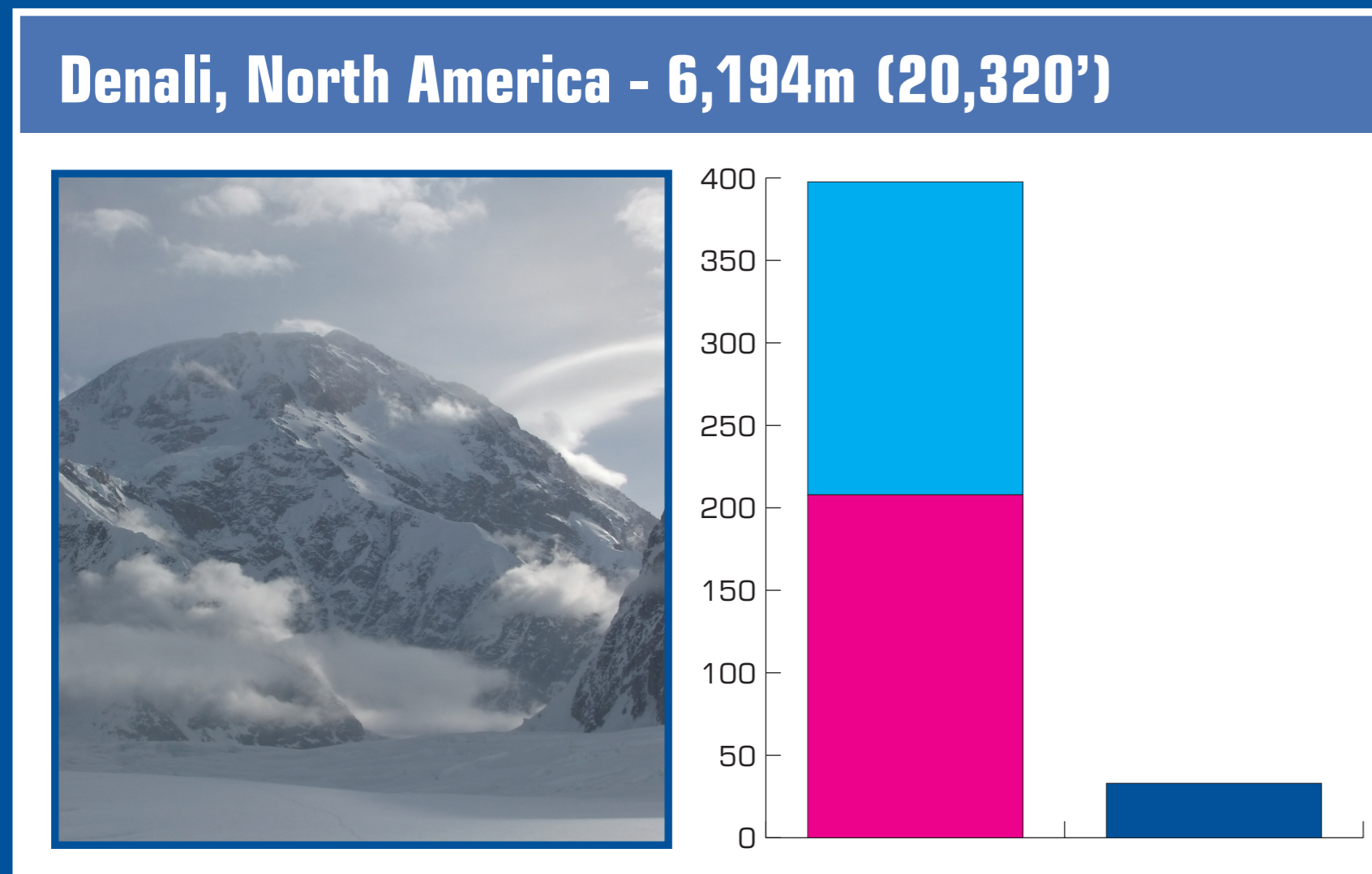
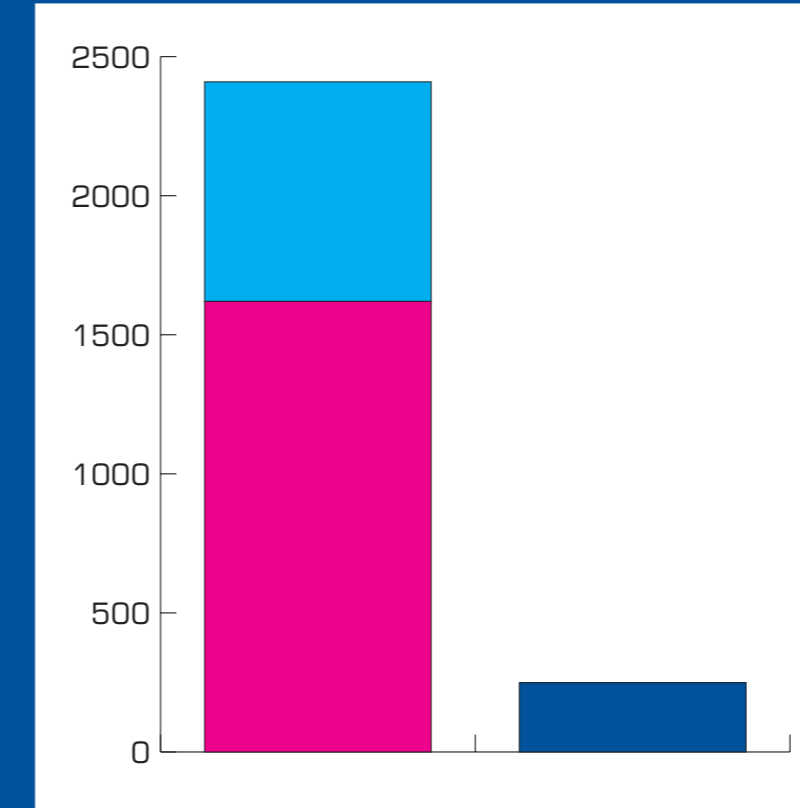
The amount of cosmic radiation dose received for each of the seven summits is illustrated in the bar graphs below. All cosmic radiation exposures estimated are based on average 2011 data calculated using reference [2].

## 3. Discussion

UK based high altitude mountain guides receive occupational cosmic radiation doses, both at ground level and during transit. To guide one client up all of the seven summits takes approximately 189 days, involves approximately 225 hours of flying and results in over 2 milliSv of occupational radiation dose of which over two thirds of the dose is received whilst at ground level overseas as shown in the graph to the right.

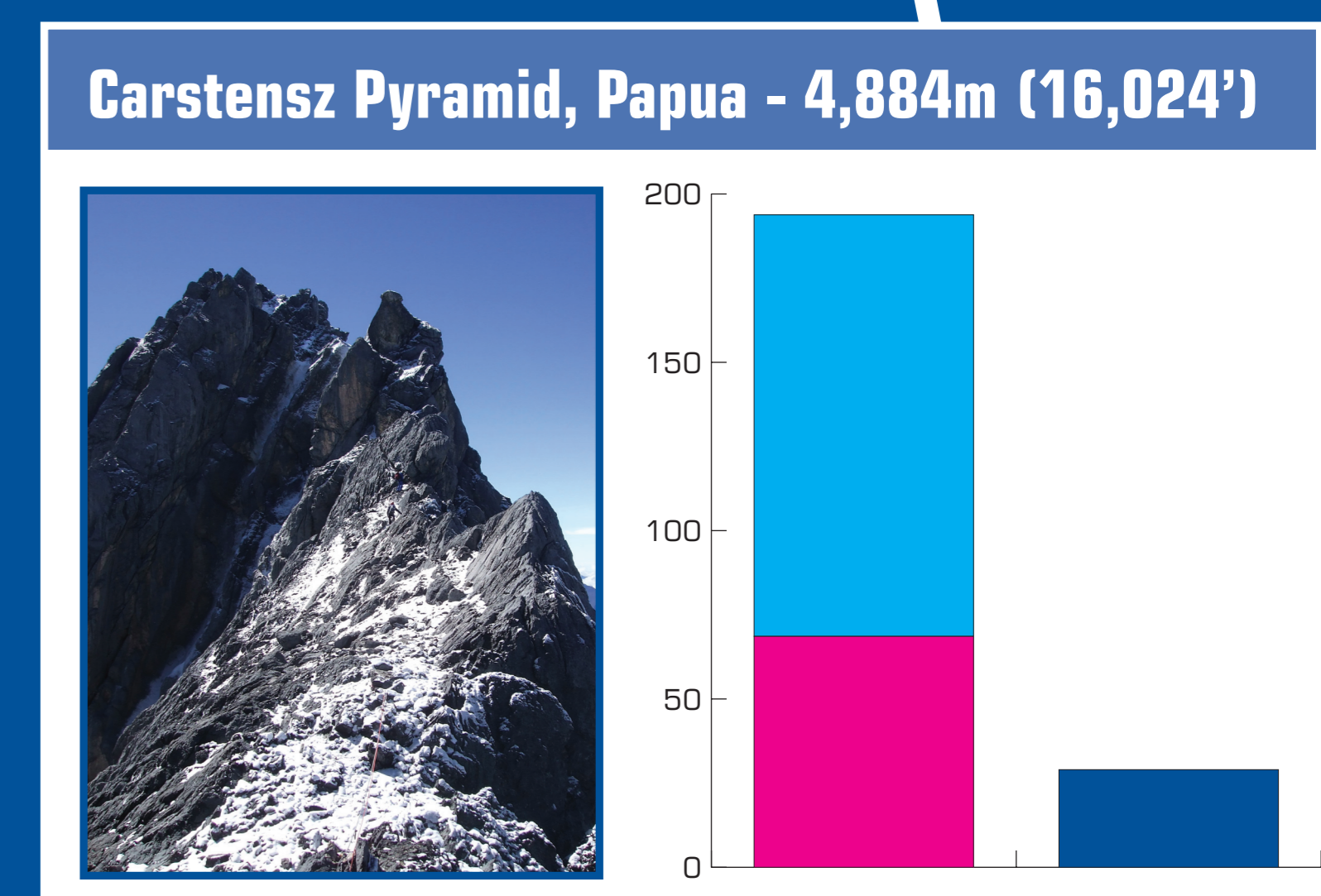
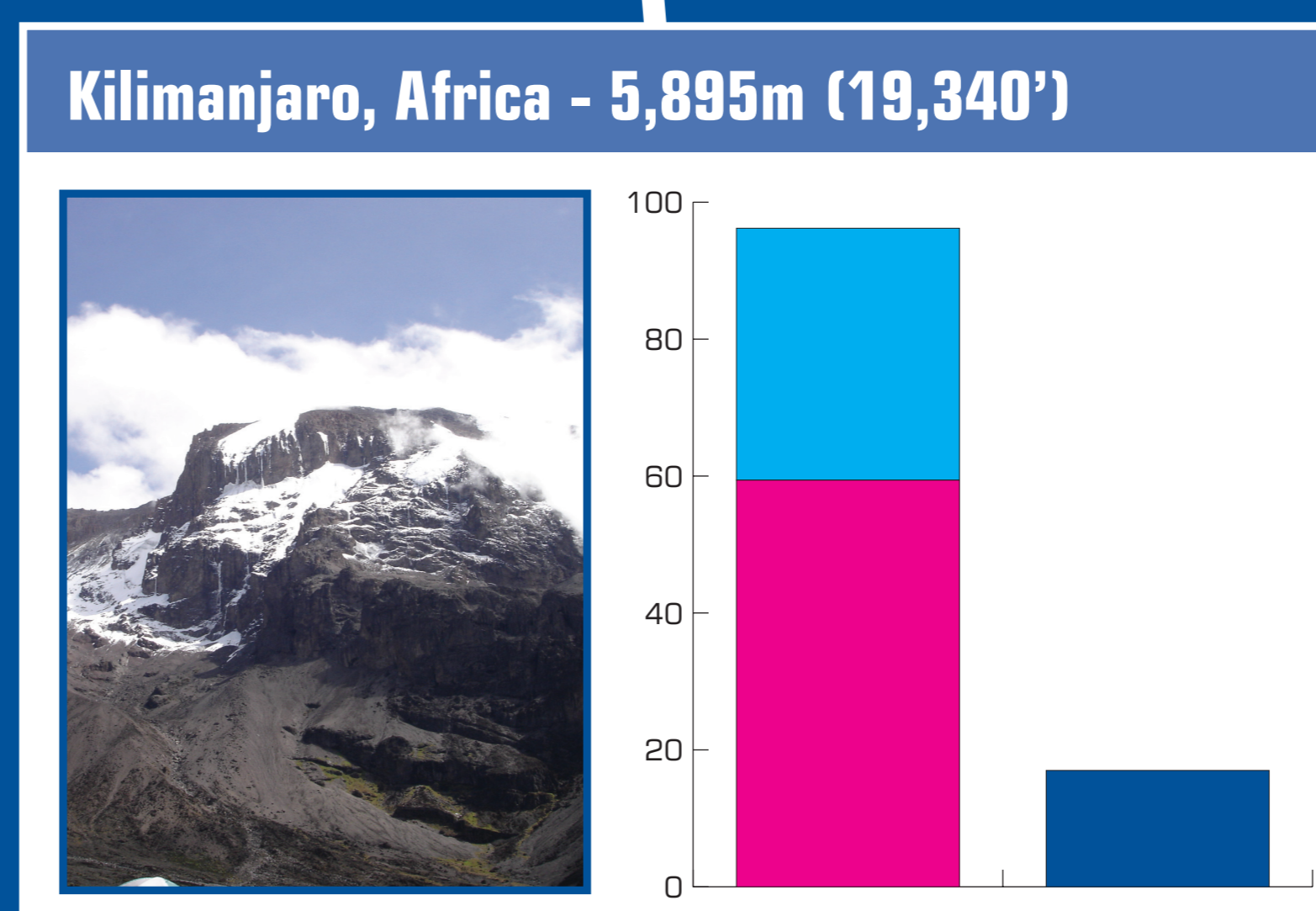
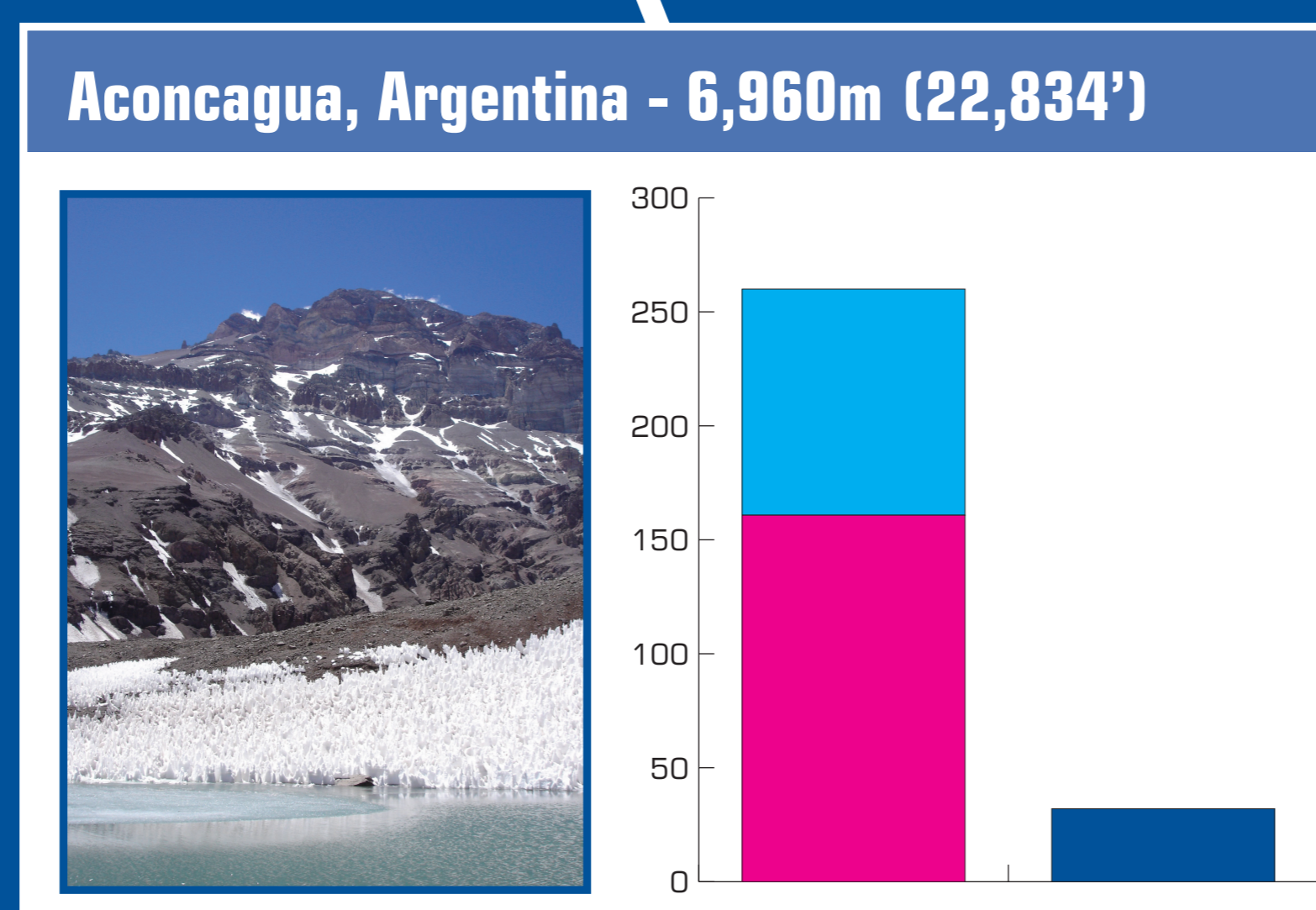
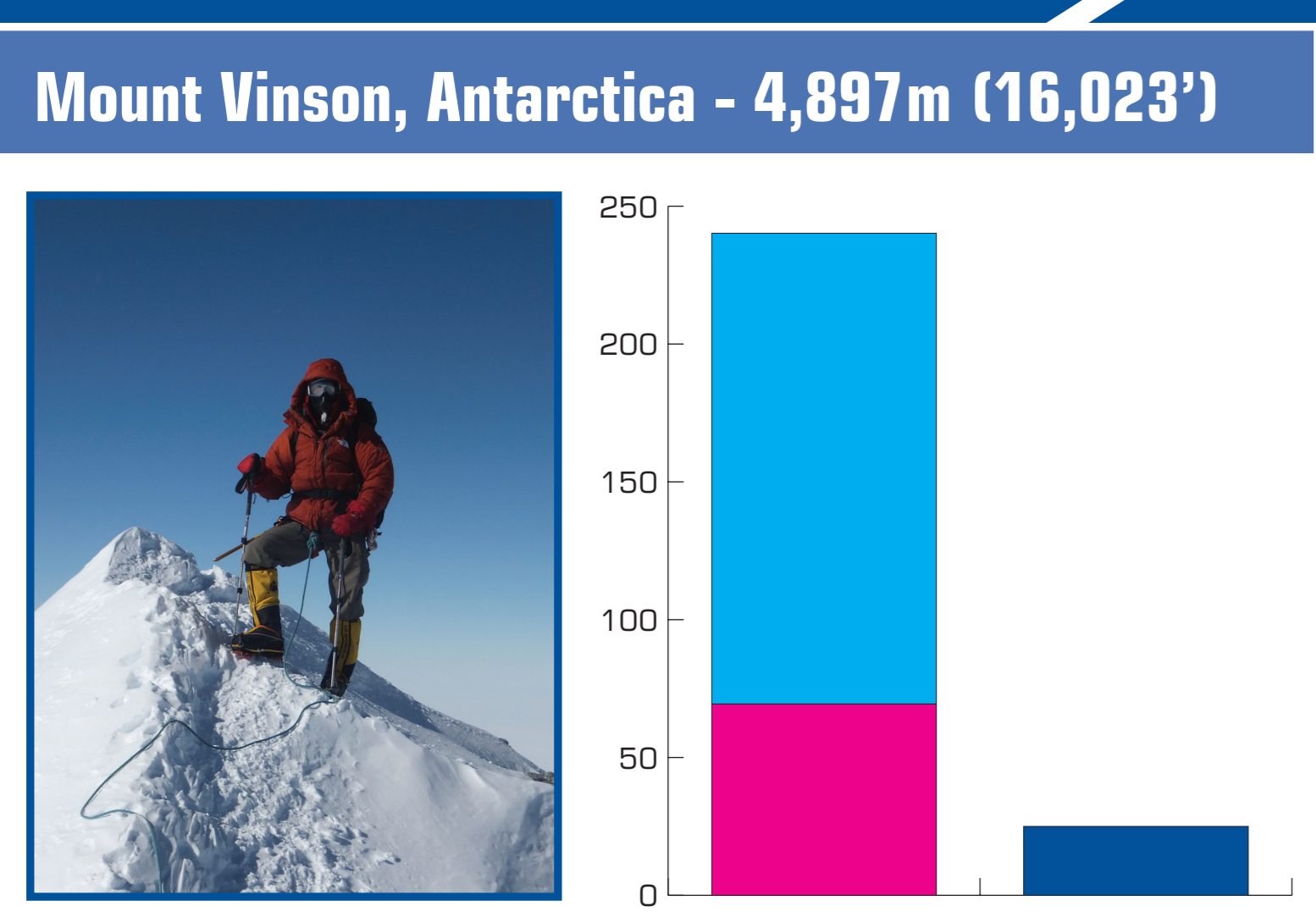
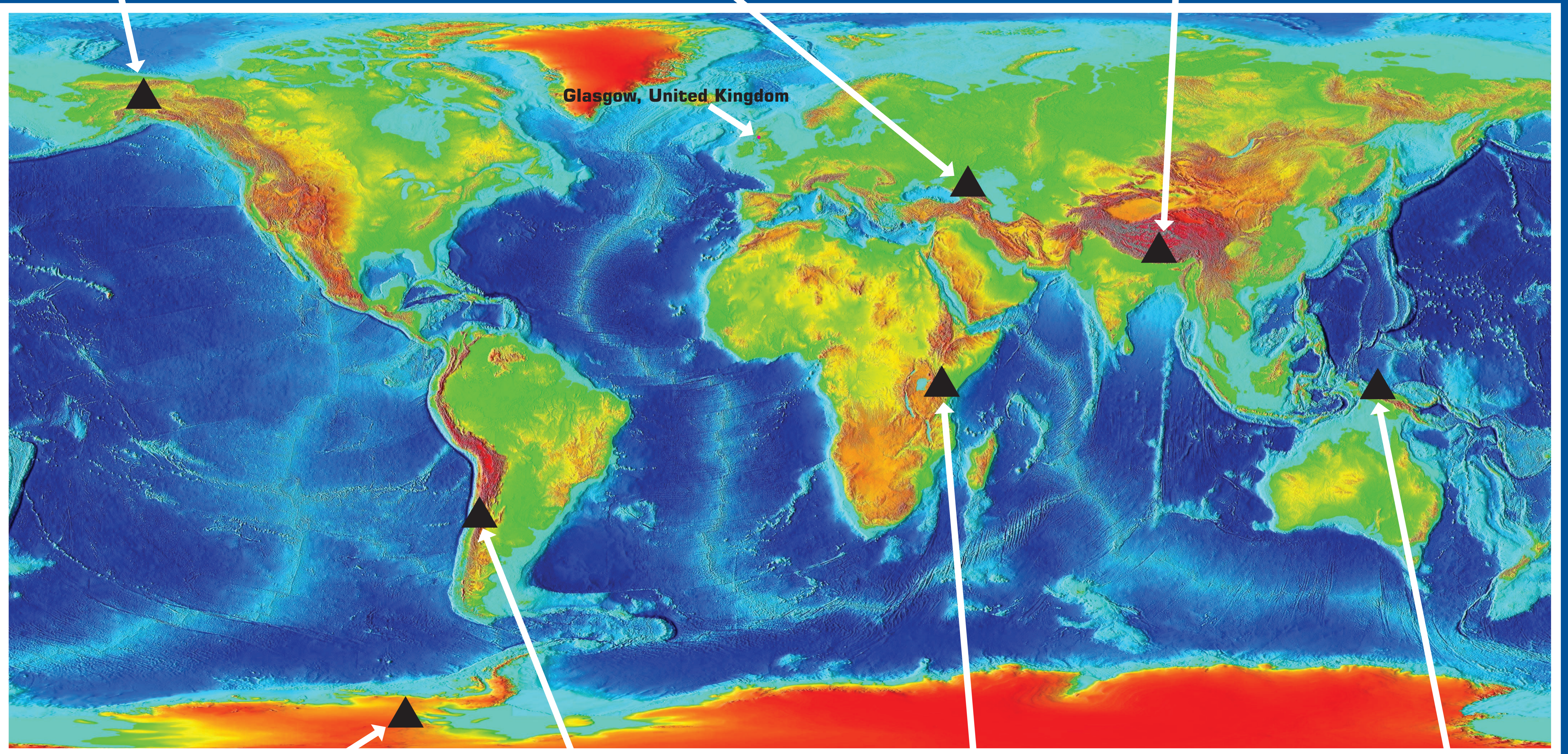


Cosmic rays are fast-moving charged particles. The Earth's magnetic field deflects cosmic rays, causing them to spiral around the magnetic field close to the poles. They ionise atoms in the atmosphere, which recombine with electrons to give off light. This causes a dramatic display of coloured light in the sky near the poles, called the aurorae. Mountain guides are occupationally exposed to cosmic radiations particularly when at high altitudes or high latitudes.



### Bar Graph Key

- Cosmic radiation dose received at ground level (microSv)
- Cosmic radiation dose received during associated flights (microSv)
- Comparative cosmic radiation dose received at ground level in Glasgow for the same duration of expedition (microSv)



An ascent of Mount Everest gives greater than 1 milliSv of dose at ground level and as such is a significant radiation dose if the UK Ionising Radiations Regulations 1999 [3] were to be applied to this existing exposure situation.

The European Community Basic Safety Standards Directive 96/29/EURATOM [4] does not apply to exposure to cosmic radiation prevailing at ground level or to passengers on aircraft. There is an anomaly in radiation protection where the cosmic radiation exposures of aircrew operating for short durations at altitudes lower than mountain guides operating at high altitudes for prolonged times have to be taken into account. UK based high altitude mountain guides are undergoing planned occupational exposures to cosmic radiation whilst still on the ground.

## 4. Conclusions

High altitude mountain guides from the United Kingdom can potentially receive greater than 1 milliSv per year of cosmic radiation dose in excess to what they would have received at UK ground level. The precise amount of dose received will vary depending on the itinerary guided. These individuals are occupationally exposed to cosmic radiation as a result of their profession.

Consideration should be given by the legislative authorities to include the control and assessment of cosmic radiation exposures of professionals likely to receive greater than 1 milliSv per year of cosmic radiation in excess of what would have been received in their home country at ground level.

In their next set of recommendations, the ICRP should consider whether the occupational cosmic radiation exposure of high altitude mountain guides should be included as a specialised group for whom some control and assessment of cosmic radiation exposures may be justified.

## REFERENCES

- [1] "Seven Summits – The Quest to Reach the Highest Point on Every Continent", by Steve Bell, 2006. ISBN 0-517-22750-9.
- [2] Federal Aviation Administration Office of Aerospace Medicine Galactic Radiation Received in Flight calculator, <http://jag.cami.jccbi.gov/cariprofile.asp>
- [3] UNITED KINGDOM LEGISLATION: The Ionising Radiations Regulations 1999, Statutory Instrument 1999/3232, ISBN 0110856147.
- [4] Council Directive 96/29/EURATOM of 13 May 1996 Laying Down the Basic Safety Standards for Protection of the Health of Workers and the General Public Against the Dangers Arising from Ionising Radiation. Official Journal of the European Communities 39, L159.

