Effect of preoxygenation on micro oxygen bubbles in adipose tissue at sea level and during 25-kPa altitude exposures

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Decompression sickness at altitude

- Decompression sickness (DCS) at altitude
  - Flying after diving
  - Fast decrease in ambient pressure
- Nitrogen super saturation causes bubble growth
  - Pre-breath O_2
- DCS at altitude
  - O_2 breathing combined with fast descent from altitude

Metabolic gases

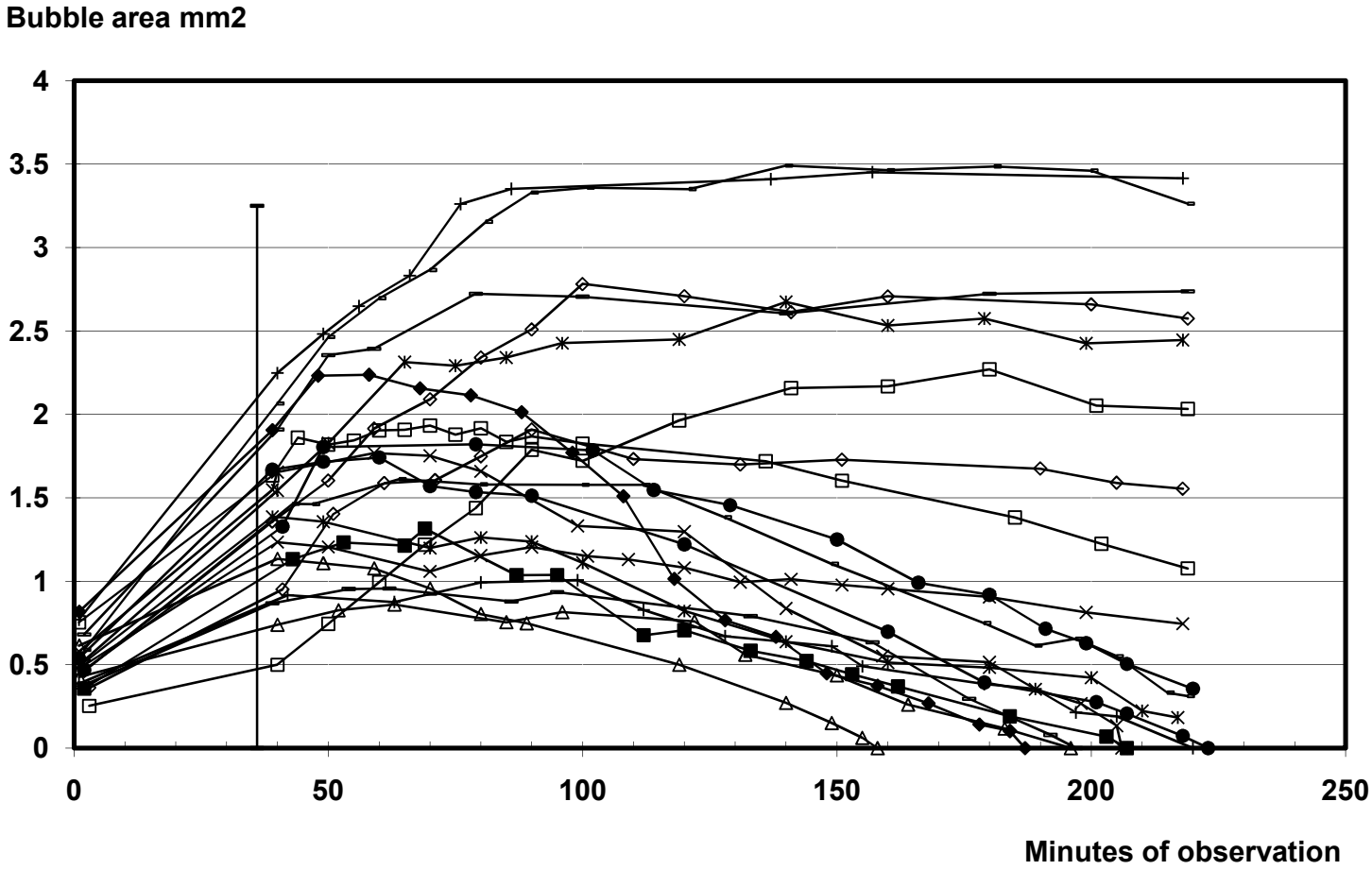
- Bubble kinetic models[1]
  - O_2, CO_2 and water vapor contribute to bubble growth
  - Effect increases during hypobaric conditions

- Animal studies[2]
  - O_2 breathing at 71 kPa and 25 kPa caused air bubble growth in adipose tissue, regardless of N_2 tension in tissue

[1] Foster et al. JAP. 1998/ Van Liew. Aviat Space Env Med. 1995

[2] Hyldegaard et al. JAP. 2008

Air bubble observation in adipose tissue.
3 hour preoxygenation followed by O_2 breathing at 25 kPa



Randsøe et al.JAP. 2008

Experimental setup

- Rats pre-breathing O_2 for 3-h to wash out N_2. $T_{½N_2}$ 29 minutes.
- Micro O_2 bubbles in adipose tissue
- Group 1:
  - Bubble observation at 101,3 kPa (sea level)
- Group 2:
  - Bubble observation at 25 kPa (~10.350 m)

[1]Madsen et al. JAP. 1975

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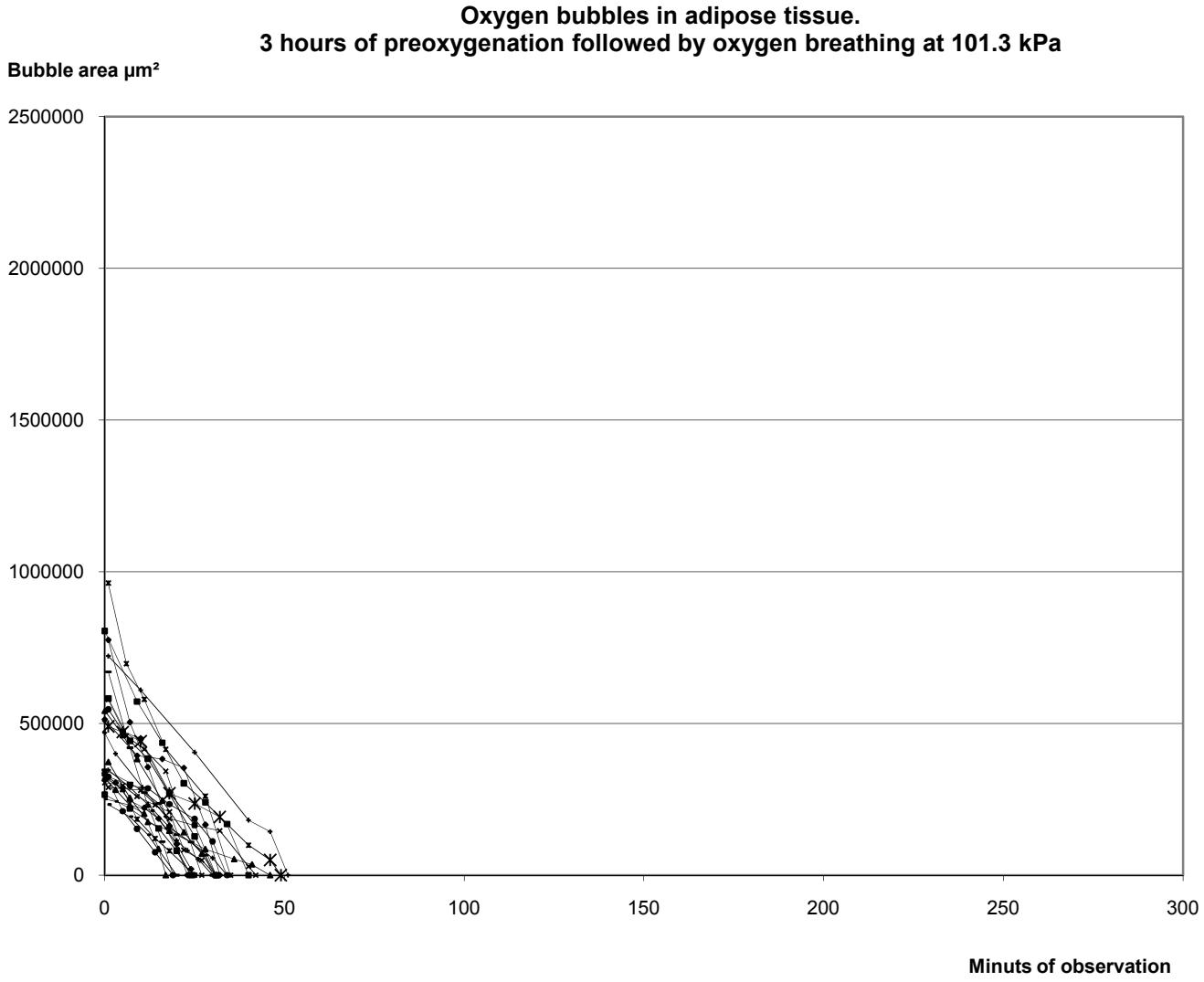
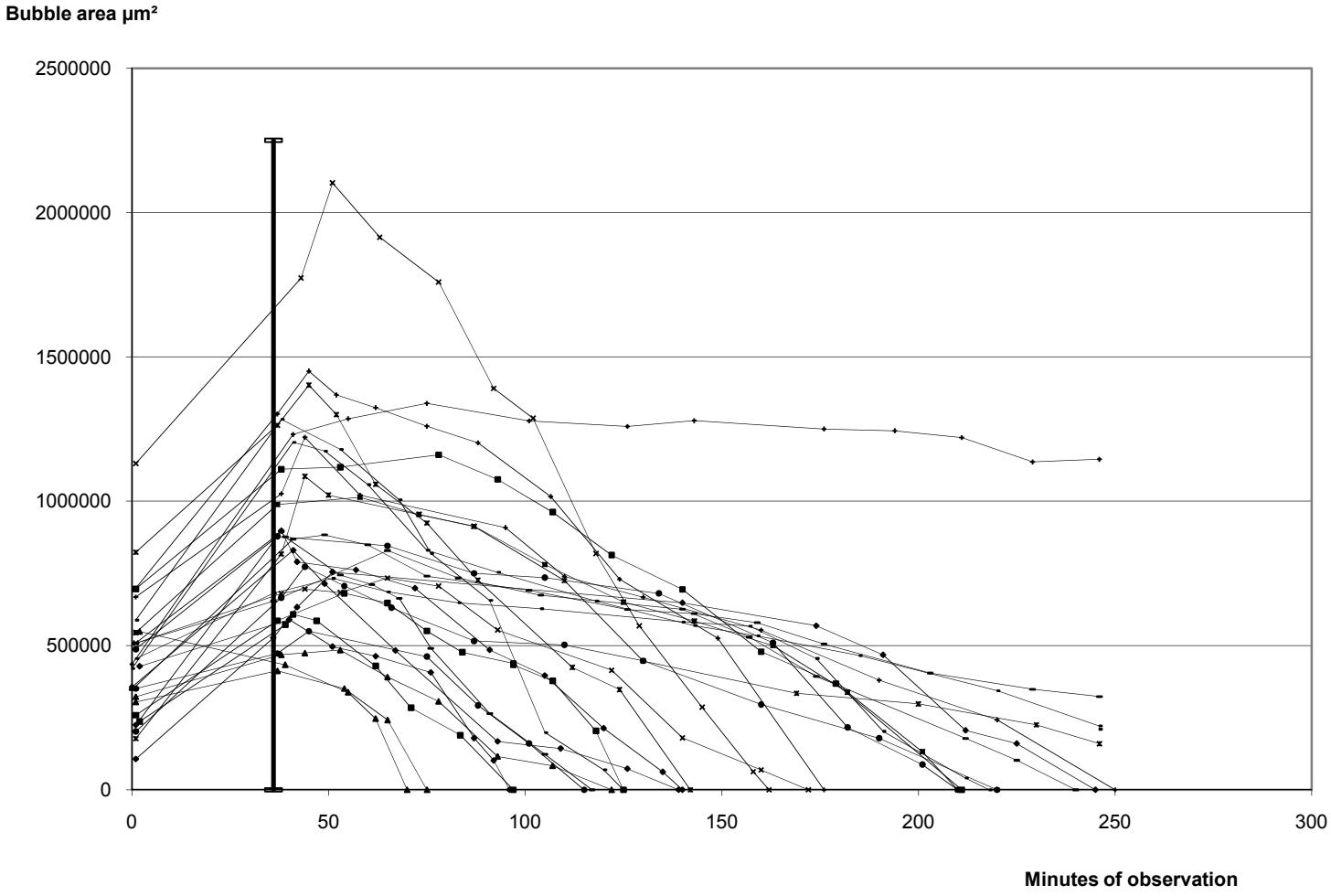
Results at sea level



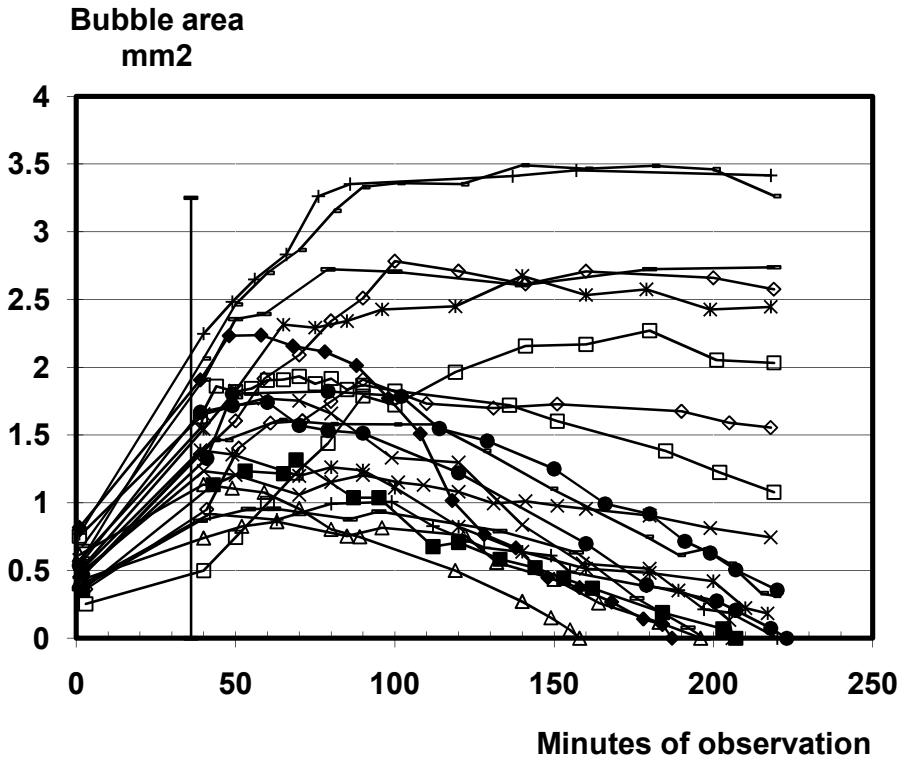
Results at altitude

Oxygen bubbles in adipose tissue.
3 hours preoxygenation followed by oxygen breathing at 25 kPa

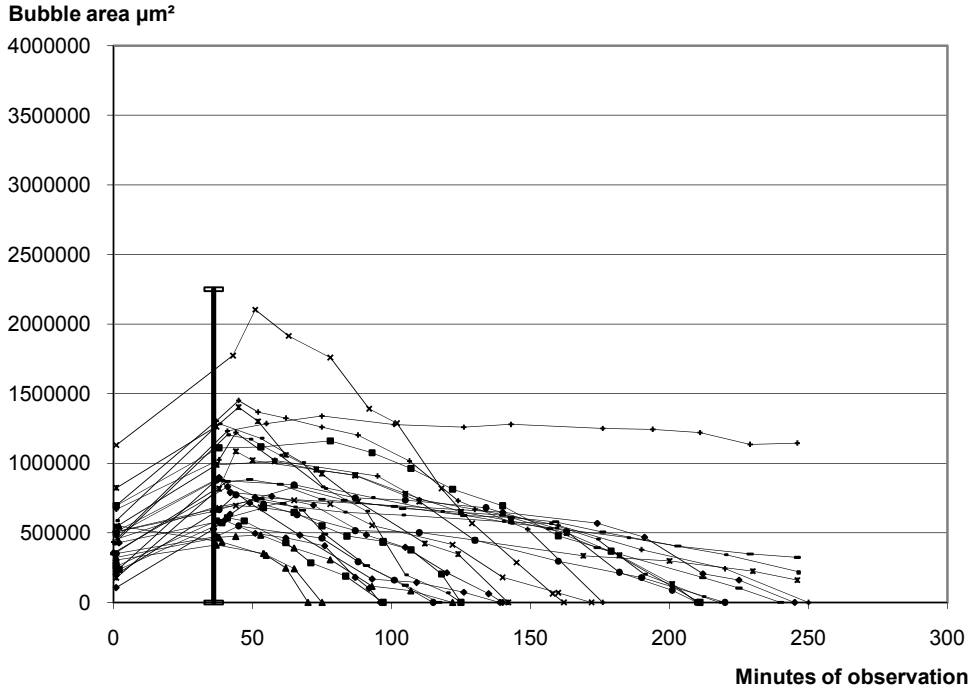


3 hours of preoxygenation followed by oxygen breathing at 25 kPa.

Air bubble (80% N_2)

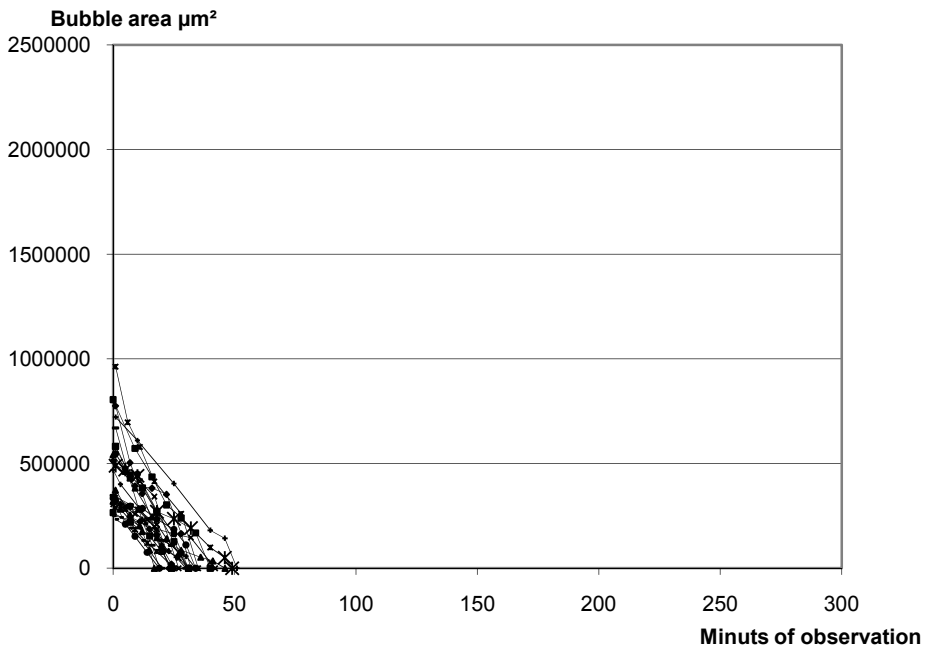


Oxygen bubble

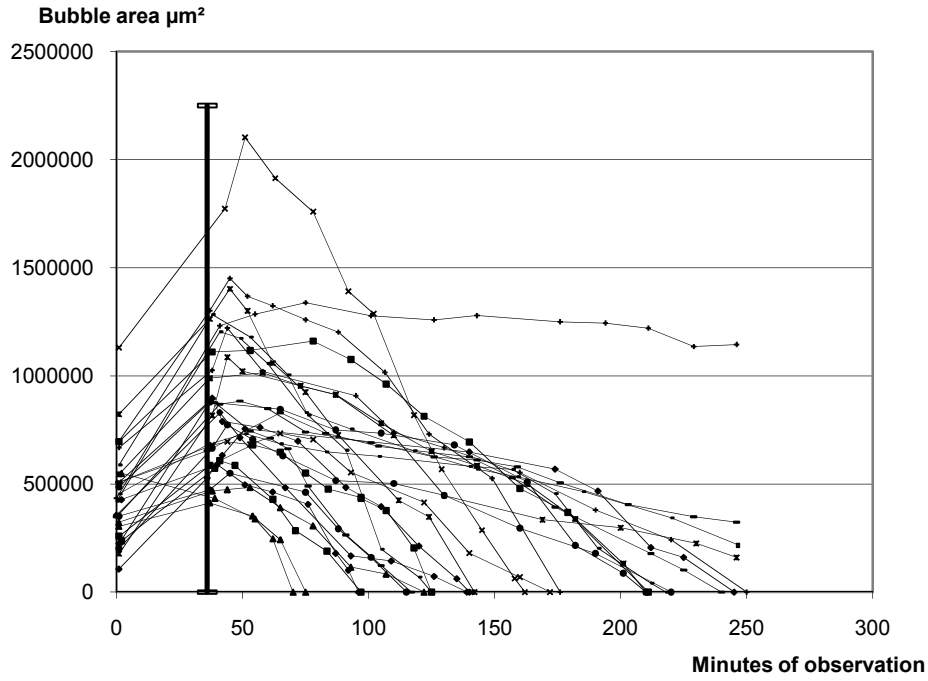


Results

Sea level (101,3 kPa)



Altitude (25 kPa)



- *Mean net disappearance rate* at 25 kPa, was significantly different from the mean *net disappearance rate* at 101.3 kPa (*P=0.0442*)

Conclusion

- Metabolic gases, oxygen in particular, contribute to bubble volume and growth during hypobaric conditions
- The effect increases, the lower the ambient pressure

Acknowledgments

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