

WHERE IN THE WORLD IS LYME DISEASE?

Lyme's ancient existence

Borrelia burgdorferi was first noted as the causative agent of Lyme disease in the United States in Lyme, Connecticut, in the mid-1970s. Due to the way its symptoms manifested in children, it was initially referred to as juvenile arthritis. However, Lyme's dermatological manifestations, including the erythema migrans ("bullseye" rash), had already been described, for example by European physicians since 1883. (1)

Until relatively recently, we didn't know that *Borrelia* has been around for thousands of years. An autopsy on a 5,300-year-old mummy known as Otzi indicated the presence of *Borrelia burgdorferi*. "The Iceman" Otzi is the earliest known case of Lyme disease. He was found in the Eastern Italian Alps in the late 20th century. (2)



Dr Eduard Egarter-Vigl and Dr Albert Zink taking a sample from the Iceman in November 2010. Image credit Samadeli Marco/EURAC

A team from the University of Bath has also shown that *Borrelia* came from Europe, originating from before the Ice Age. They analysed 64 different samples taken from infected humans and ticks in Europe and America. The study's findings appear to show that *Borrelia burgdorferi* originated in Europe but that the species has been present in North America for a long time.

The researchers suggest its re-emergence there in the 1970s occurred after the geographic territory of the tick that carries the bacteria expanded, for example through the restoration of woodland. (3)

Which Borrelia, where?

Borrelia burgdorferi is the predominant cause of Lyme in North America, and *Borrelia afzelii* and *Borrelia garinii* in Europe and Asia.

According to the US Centre for Disease Control, *B. burgdorferi sensu stricto* (in the narrowest sense) is also a cause in Europe and Asia. *Borrelia mayonii*, a type of bacteria recently found in North America, can also cause Lyme disease. It is the only species besides *B. burgdorferi* shown to cause Lyme disease in North America. (4)

And then there is *Borrelia miyamotoi*, a relation of Lyme-causing *Borrelia* and a known cause of Tick-Borne Relapsing Fever. It was first found in Japan in 1995 but has since been found in Russia and North America. (5)

Which ticks, where?

Ixodes scapularis is the principal vector found in the Northeast and Central United States and Canada, whereas *Ixodes pacificus* is more common on the US Pacific coast. *Ixodes ricinus* is the principal vector in Europe. The vector in Asia is the taiga tick, *Ixodes persulcatus*. (6)



Australian Paralysis tick *Ixodes holocyclus*. Unfed female (left) and engorged female (right) Image: Jeff Wright/Qld Museum

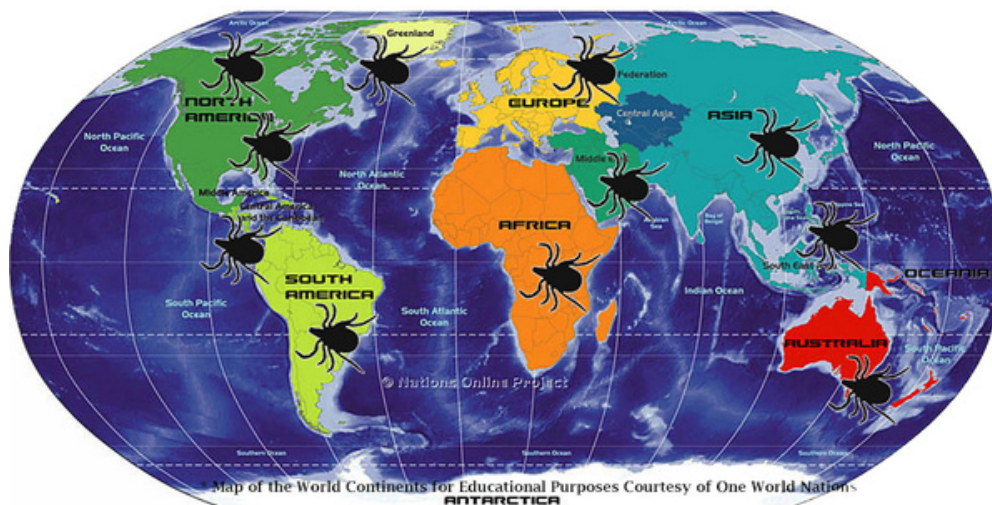
In Australia, the tick most likely to carry Lyme is *Ixodes holocyclus*, the Paralysis tick. However, Lyme may be transmitted by other methods including other vectors (e.g. mosquitoes).

Where does Lyme live today?

Lyme disease exists throughout much of the world. According to the European Centre for Disease Control and Prevention, it is considered endemic in North America, Europe, and Asia. It is the most common vector-borne disease in the United States.

Like other aspects of this disease, the subject of which countries Lyme *Borrelia* inhabits is controversial and hotly debated.

In Asia, *Borrelia burgdorferi* infection has been reported in countries including China, Korea, Japan, Indonesia, Nepal, and eastern Turkey. In Europe, most Lyme disease is reported by Scandinavian countries, Germany, Austria, and Slovenia. (7)



Lymedisease.org's Lyme location map
We now know Lyme is also found in the subantarctic region

But it appears to be far more widespread than this. On the following page is a list compiled by the US Lyme Disease Association (LDA) of countries in which information seems to support the occurrence of Lyme disease. Countries named are not necessarily endemic for Lyme.

The countries marked with a + are those where there is evidence of Lyme disease such as infected ticks, infected animals, seropositive human samples, or small numbers of diagnosed cases, but where officials are still reluctant to declare Lyme disease present.

Algeria	Germany	Montenegro
Andorra	Herzegovina	Morocco
Argentina+	Honduras+	Mozambique
Australia+	Hungary	Netherlands
Austria	Iceland	Norway
Belarus	India	Peru
Belgium	Iran	Poland
Belize	Iraq	Portugal
Bolivia+	Ireland	Romania
Brazil	Israel	Russia
Bulgaria	Italy	Scotland
Canada	Japan	Senegal
Chile+	Kazakhstan	Serbia
China	Kenya	Siberia
Colombia+	Korea Dem.	Slovakia
Croatia	Korea Rep.	Slovenia
Cuba+	Latvia	Spain
Cyprus	Liechtenstein	Sweden
Czech Rp.	Lithuania	Switzerland
Denmark	Luxembourg	Taiwan
Egypt+	Macedonia	Tajikistan
England	Mali	Tunisia
Estonia	Malta	Turkey
Finland	Mauritania	Ukraine
France	Mexico	Uruguay
Georgia	Moldova	Uzbekistan
Greece	Mongolia+	Venezuela
		Wales

Disclaimer: This information is not meant to be a scientific declaration of the presence or absence of Lyme. The US Lyme Disease Association did not check all countries worldwide nor did it contact country officials for verification. NOTE: Disease standards may vary in different countries.

Like humans, animals, plants and pathogens, ticks can travel the world; in fact they have even made it to the subantarctic region.

It is worth noting that various species of deer, vectors for Lyme disease and hosts of *Ixodes scapularis* (deer tick or black-legged tick), are found throughout Australia.

According to the “Encyclopedia of the Antarctic Vol.1” (ed: B. Riffenburg, 2007 p.335) Lyme is carried by migratory/sea birds transmitted by *Ixodes* ticks. It has been found through DNA analysis in ticks on the subantarctic Campbell Islands and Îles Crozet. King penguins on the Îles Crozet have antibodies to *Borrelia burgdorferi*. (8)

So - why on earth wouldn't Lyme be in Australia?

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 6. MD John O Meyerhoff, “Lyme Disease,” Practice Essentials, Background, Etiology (Medscape, April 27, 2021), <https://emedicine.medscape.com/article/330178-overview#a5>.
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