

# USE OF CARBON-14 AND TRITIUM TO INVESTIGATE FLOW AND STORAGE OF WATER IN THE CHRISTCHURCH GROUNDWATER SYSTEM

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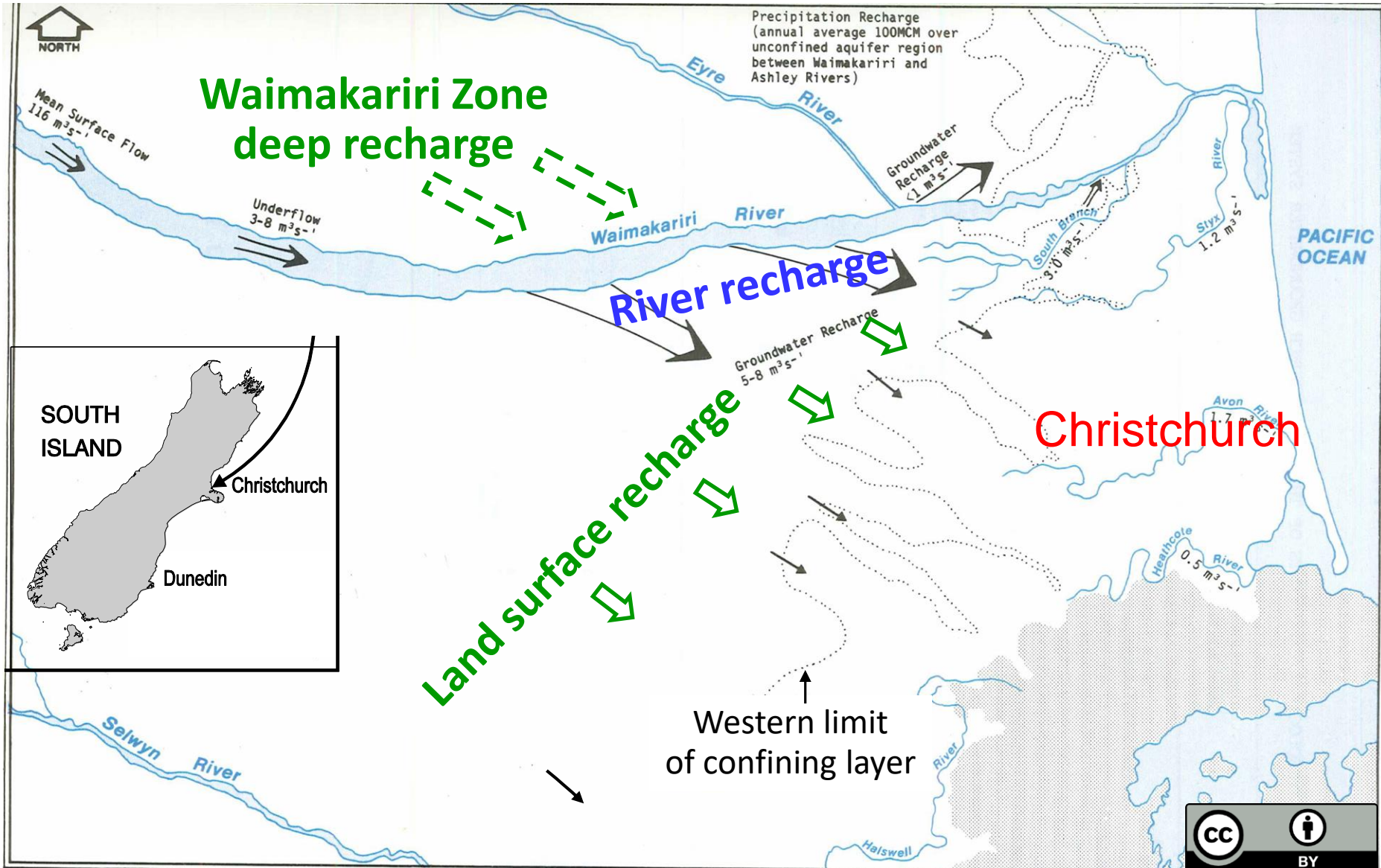


# Outline

1. Background - Christchurch Aquifer System (CAS)
2. Water source indicators ( $^{18}\text{O}$ ,  $^{13}\text{C}$ , chemistry)
3. Age dating results ( $^3\text{H}$ ,  $^{14}\text{C}$ )
4. Water turnover rates in the system
5. Conclusions

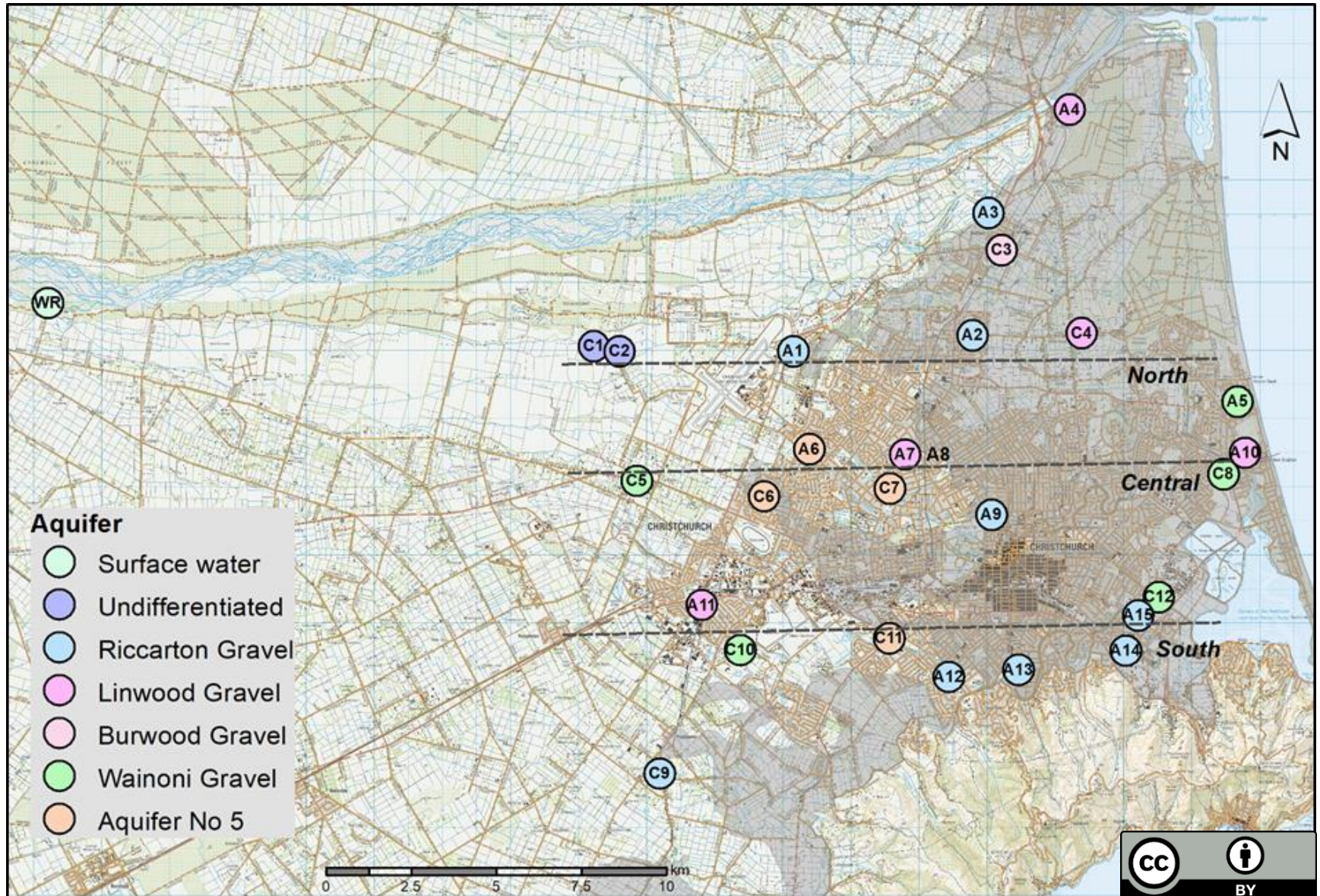


# 1. Hydrological components of Christchurch groundwater

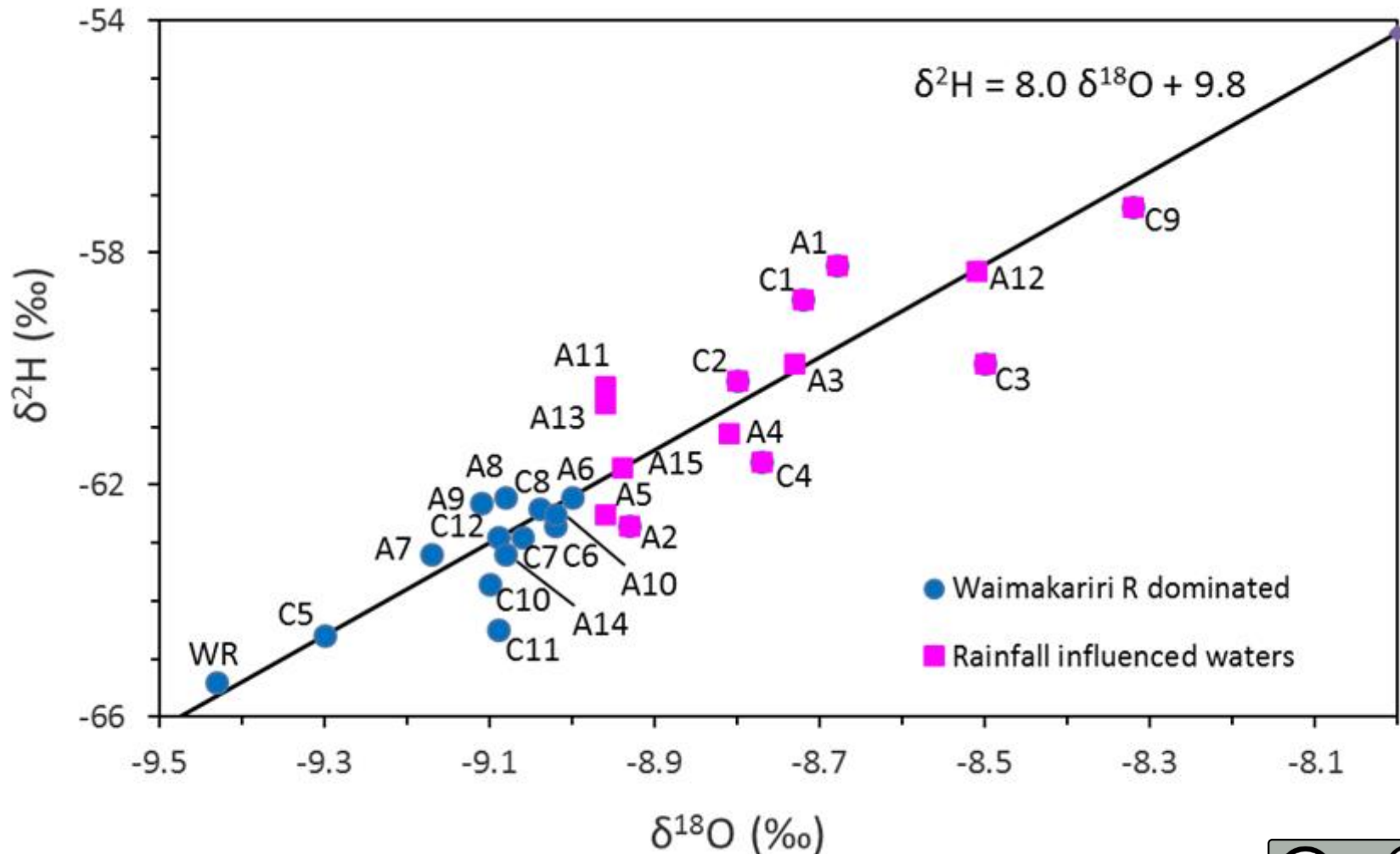




**C –  $^{14}\text{C}$  samples, A –  $^3\text{H}$  samples, dashed lines show transects.**



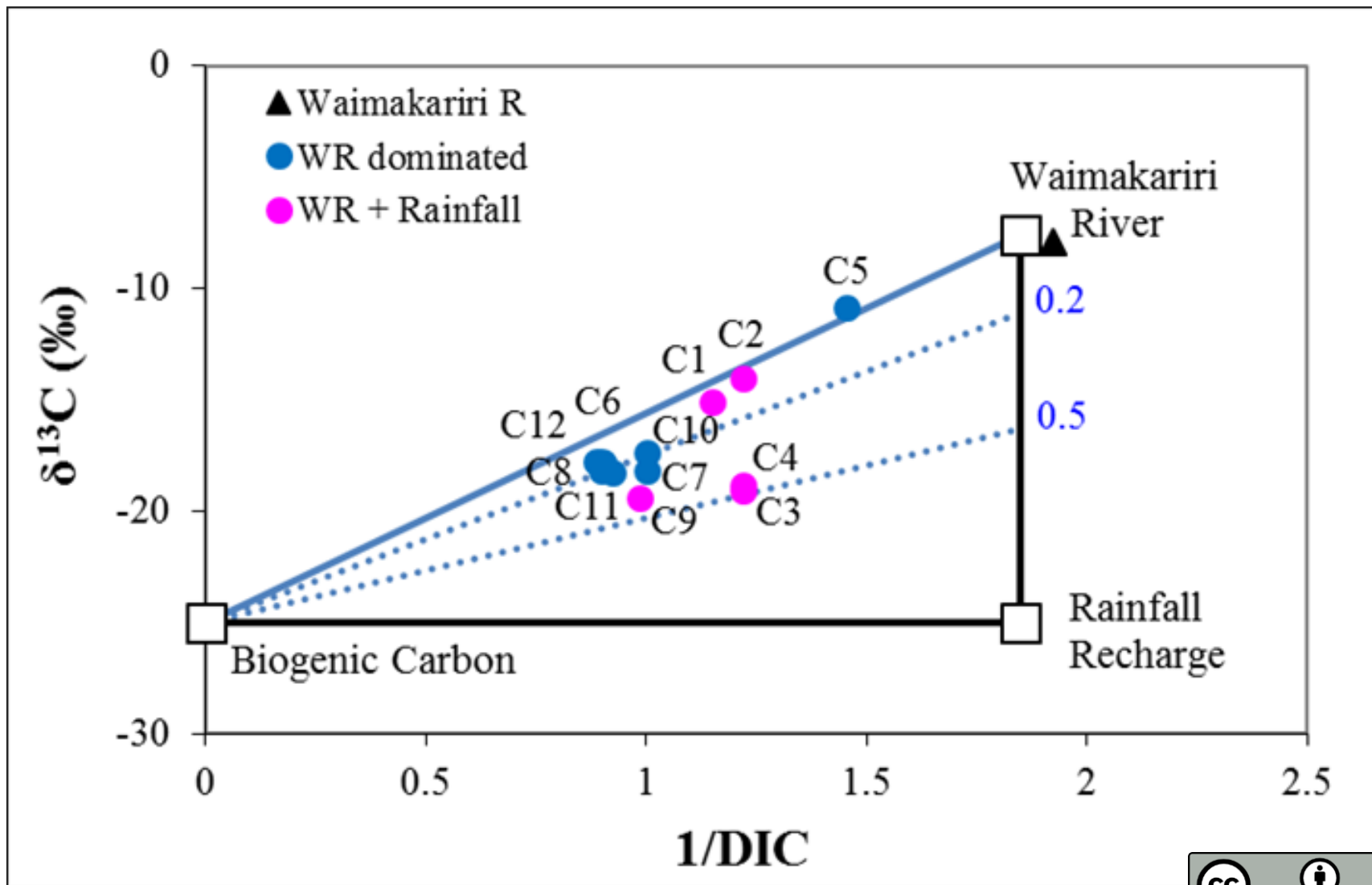
## 2. Source indications - $\delta^{18}\text{O}$ and $\delta^2\text{H}$ values (C – $^{14}\text{C}$ samples, A – $^3\text{H}$ samples)



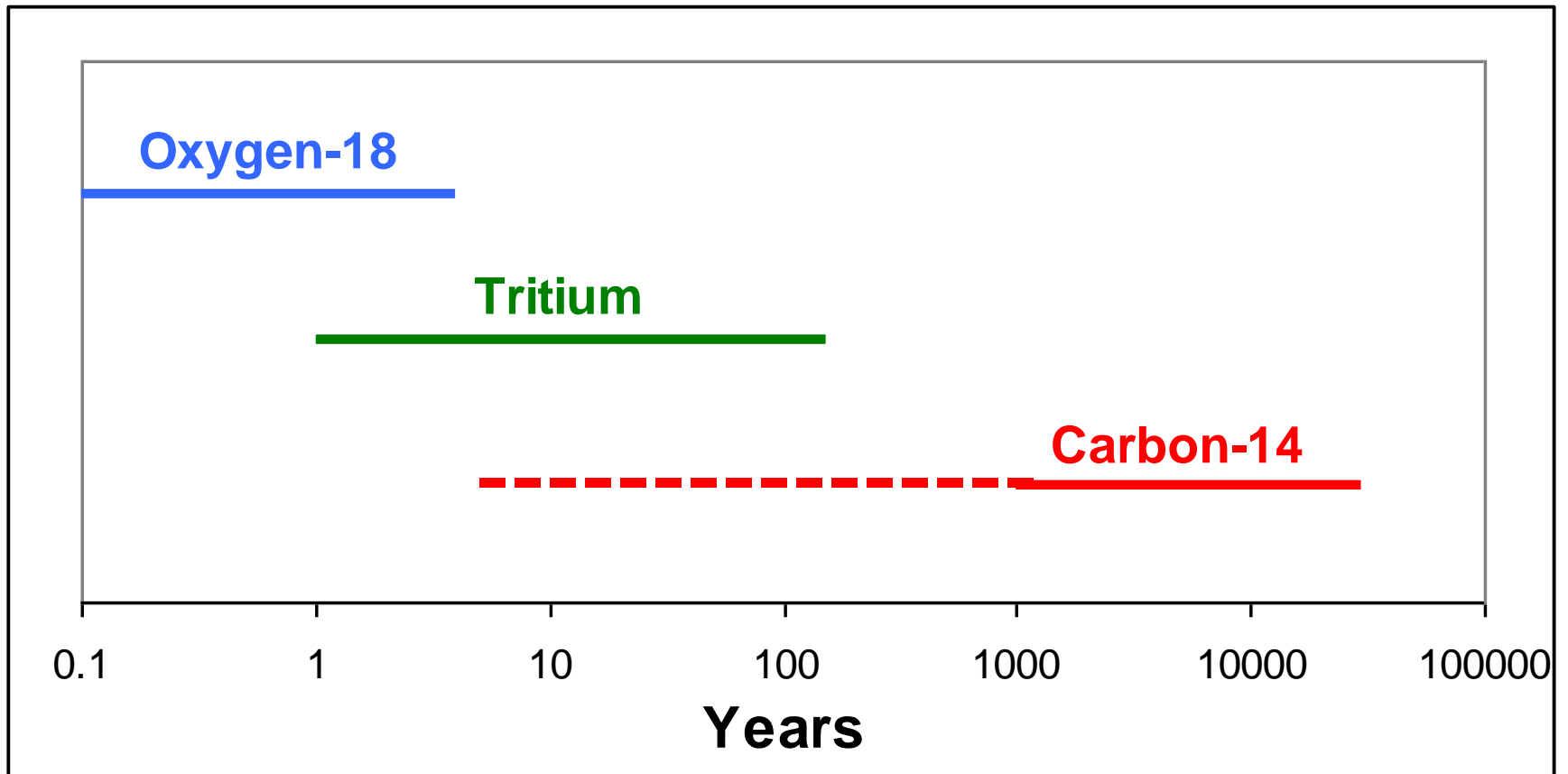


# Carbon-13 vs 1/DIC for 2017 samples

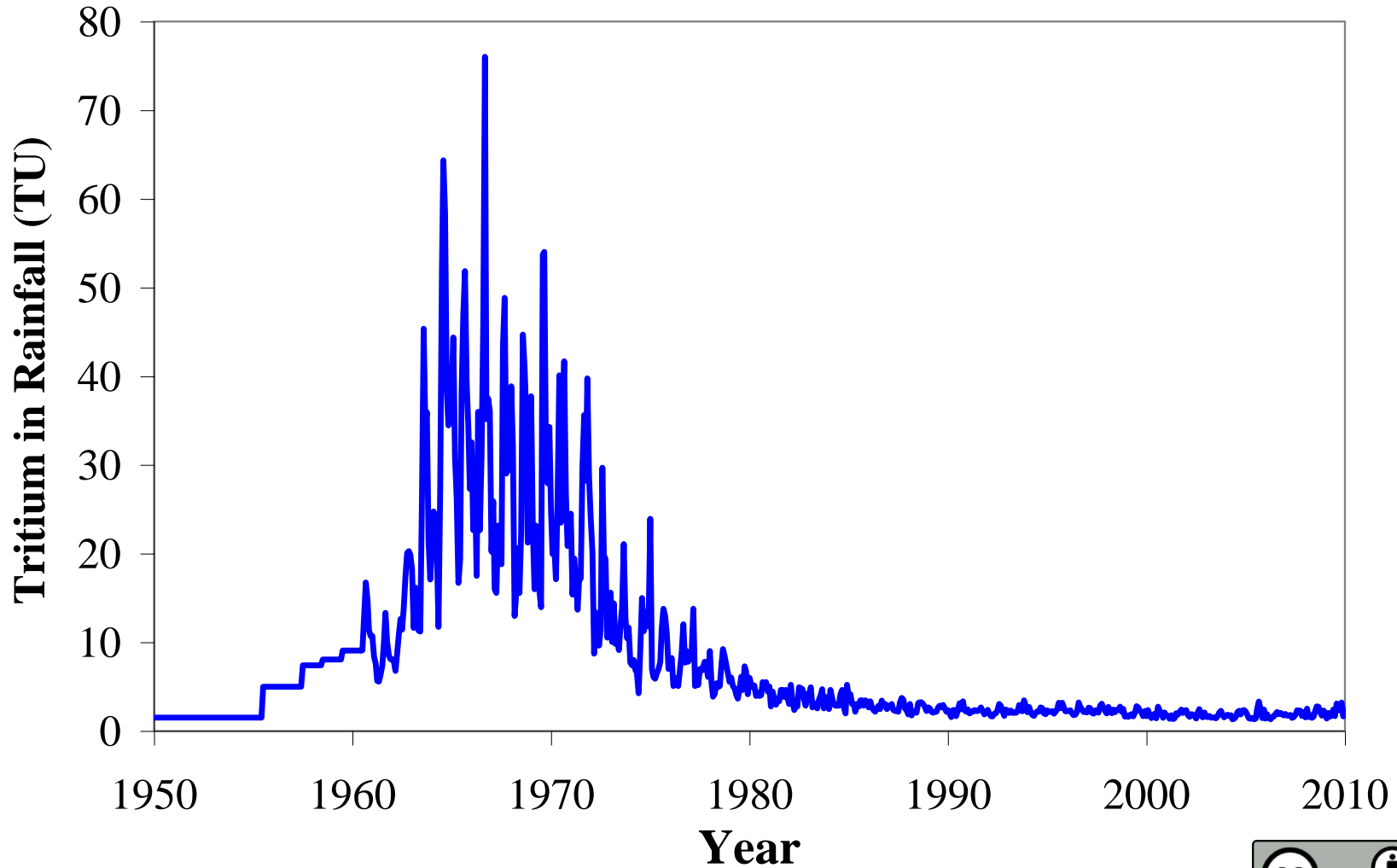
(DIC is dissolved inorganic carbon)



### 3. Age dating - Effective ranges for tritium and carbon-14

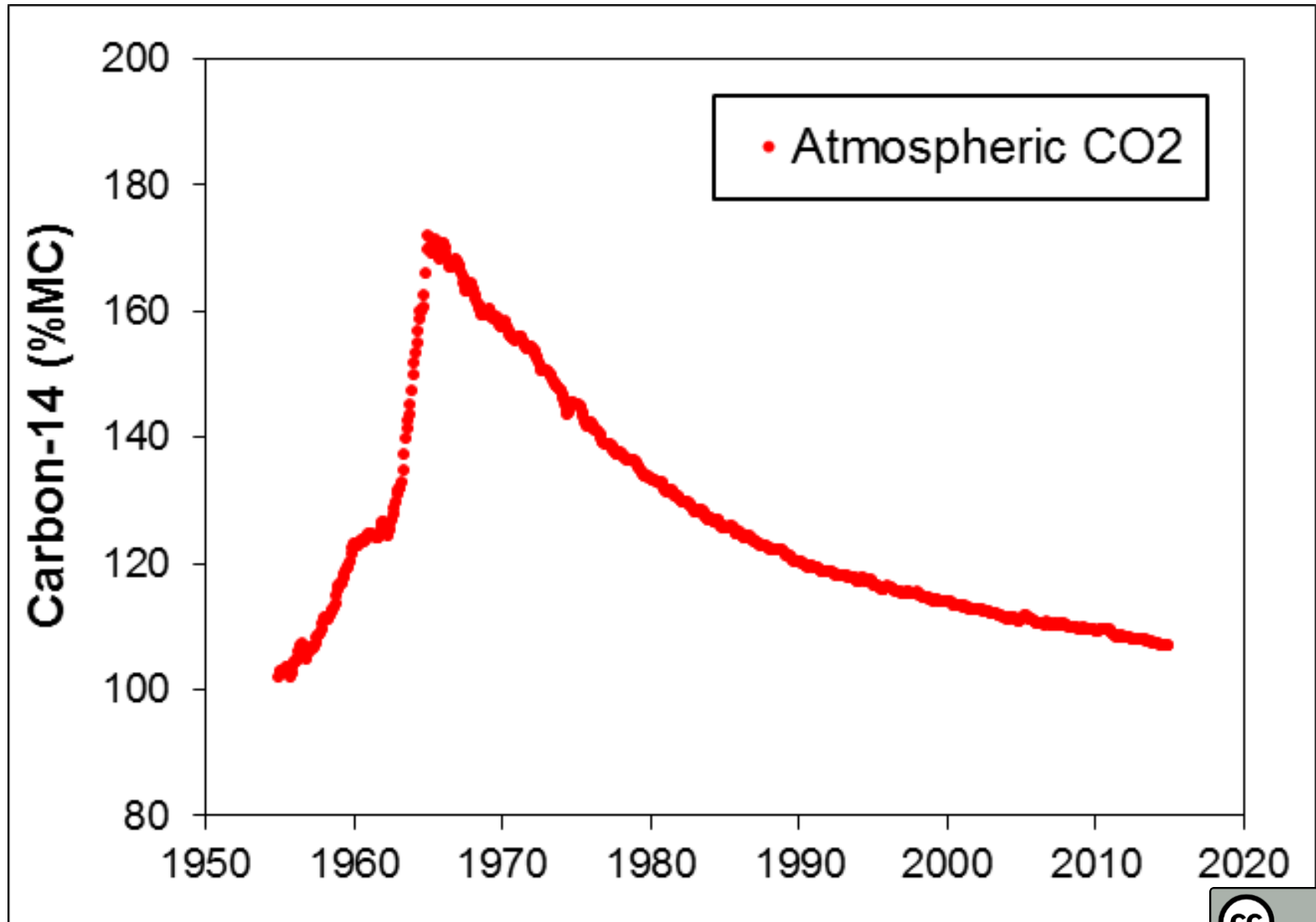


# $^3\text{H}$ concentration in rainfall (monthly samples)

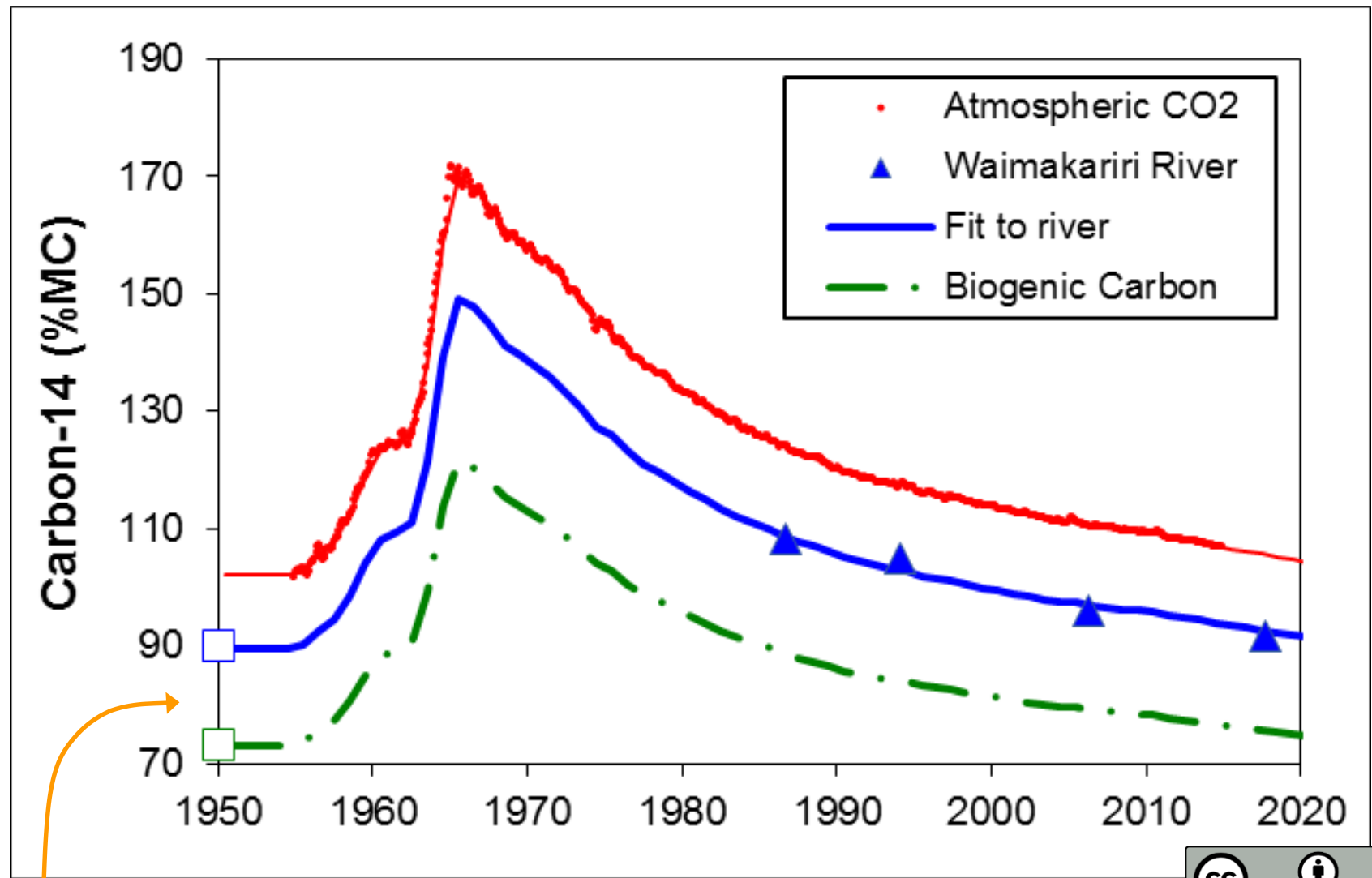




# $^{14}\text{C}$ in atmospheric $\text{CO}_2$ - 60 years data

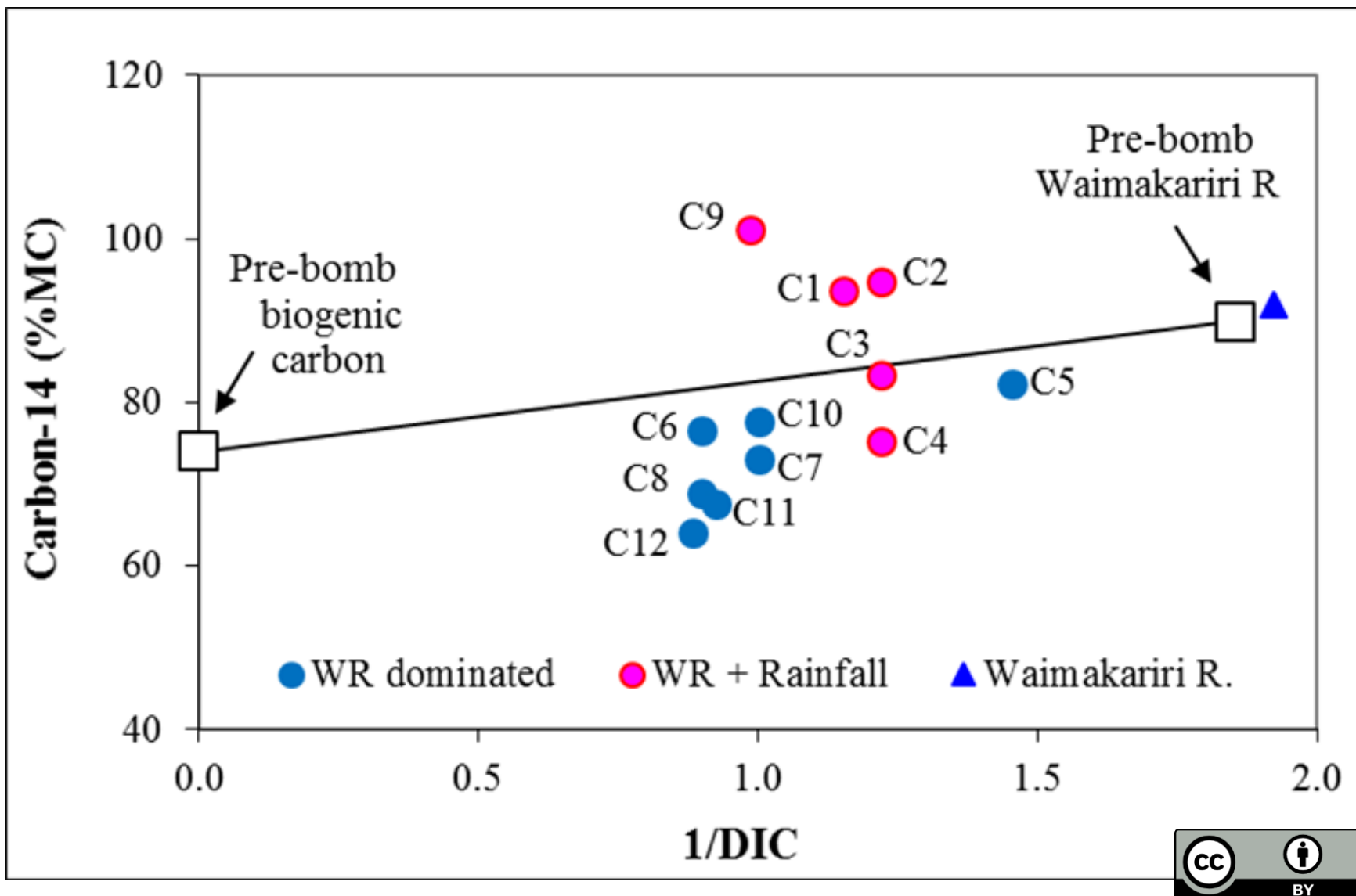


# $^{14}\text{C}$ in the Waimakariri River and biogenic carbon

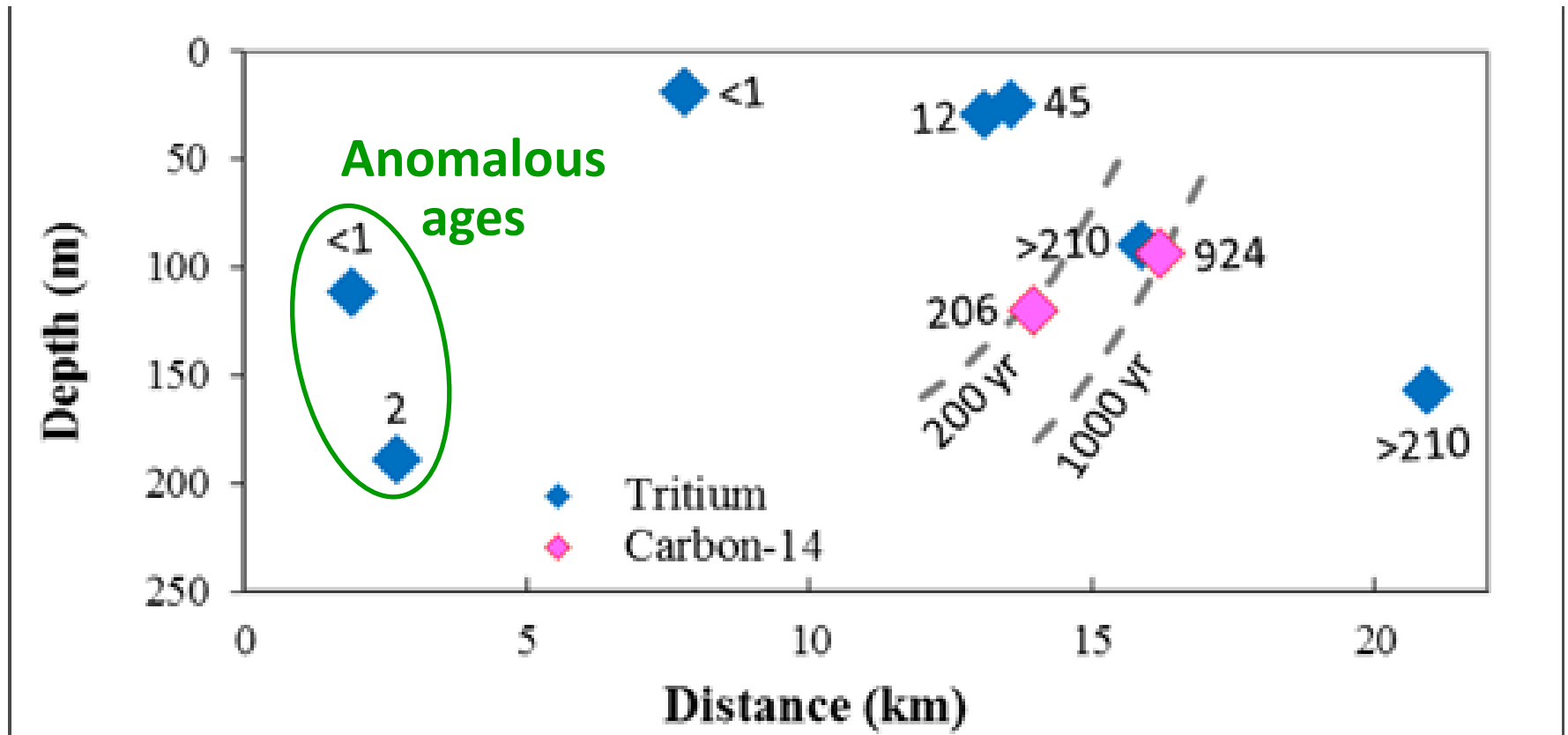


Open squares are pre-bomb values

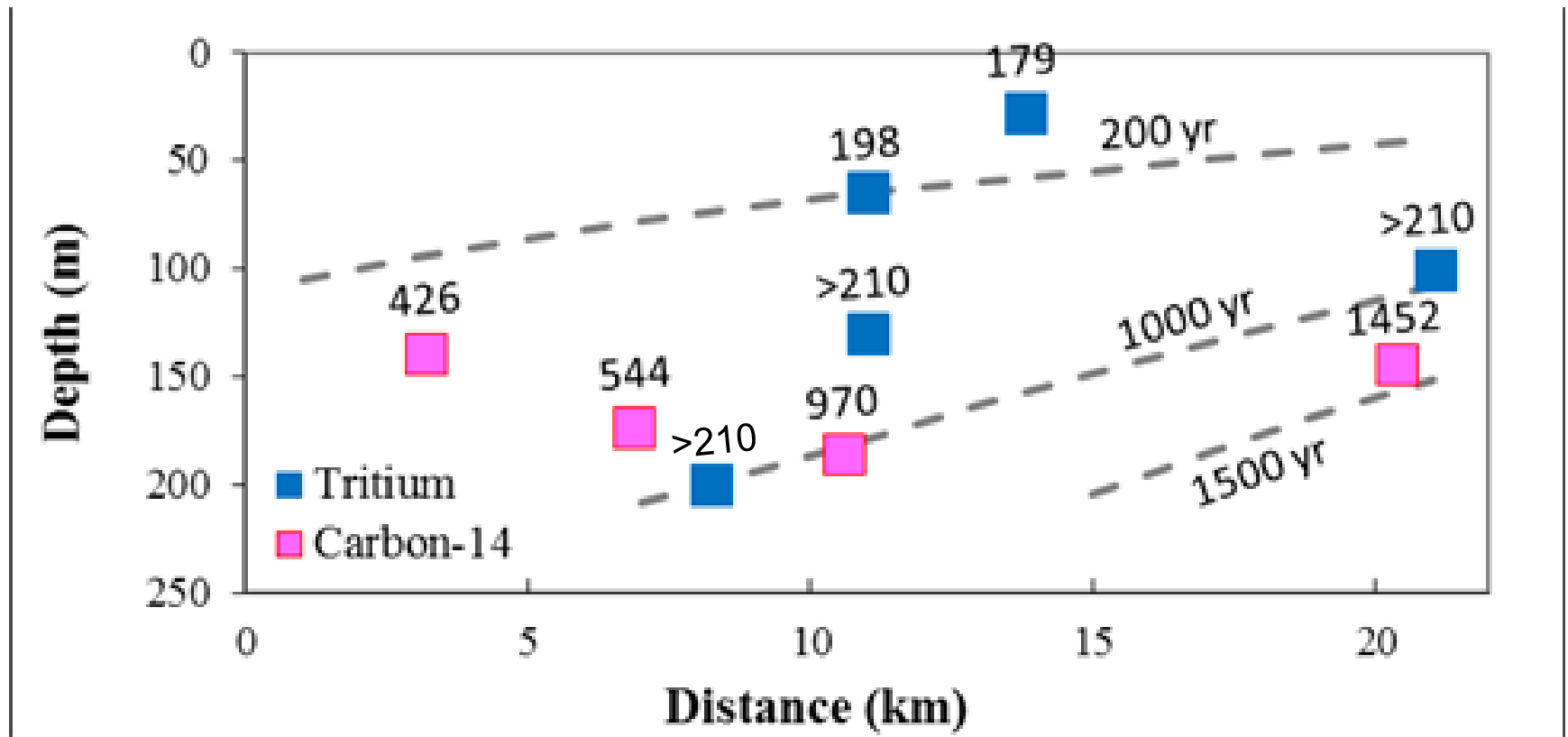
# $^{14}\text{C}$ vs $1/\text{DIC}$ for 2017 samples



# North transect mean ages in 2017

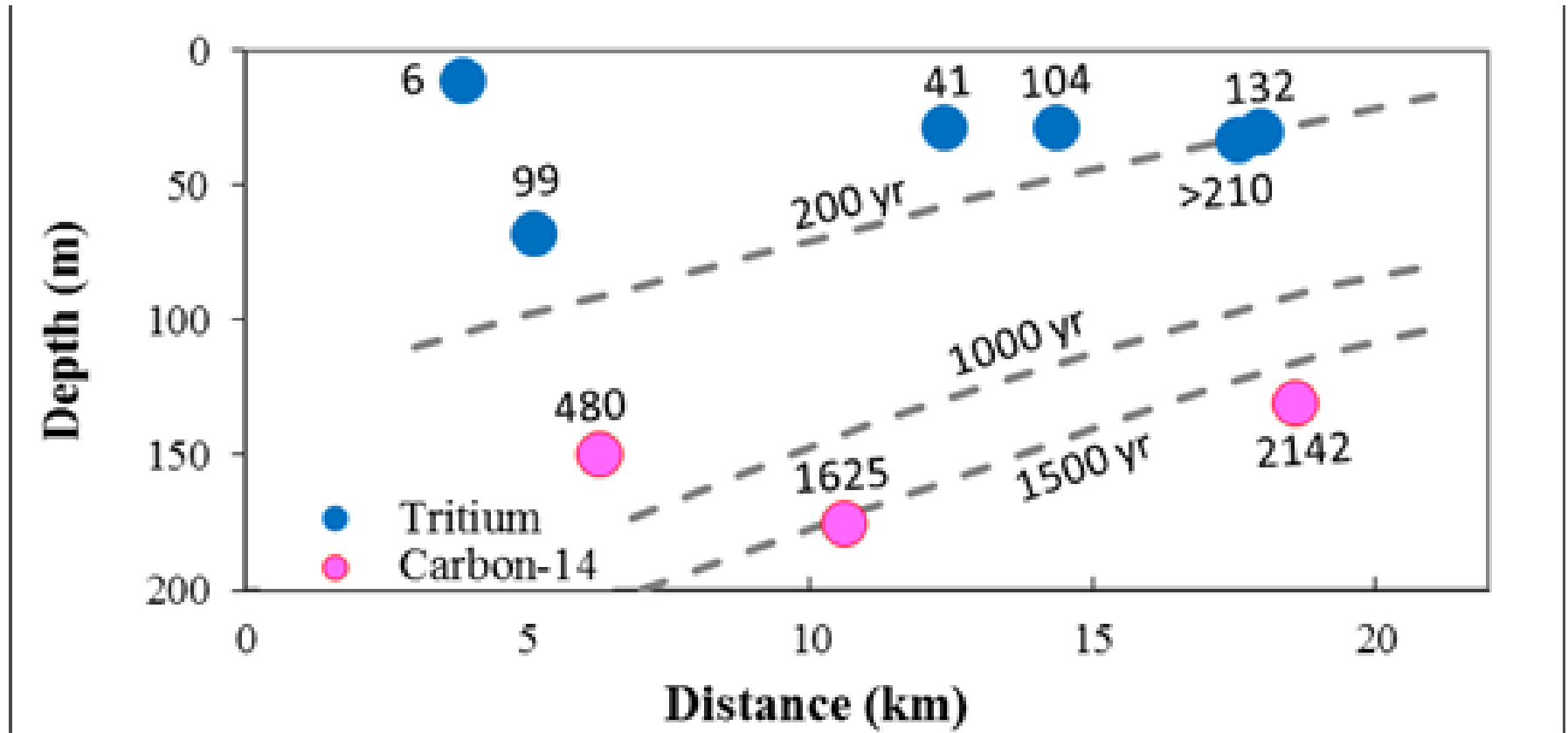


# Central transect mean ages in 2017

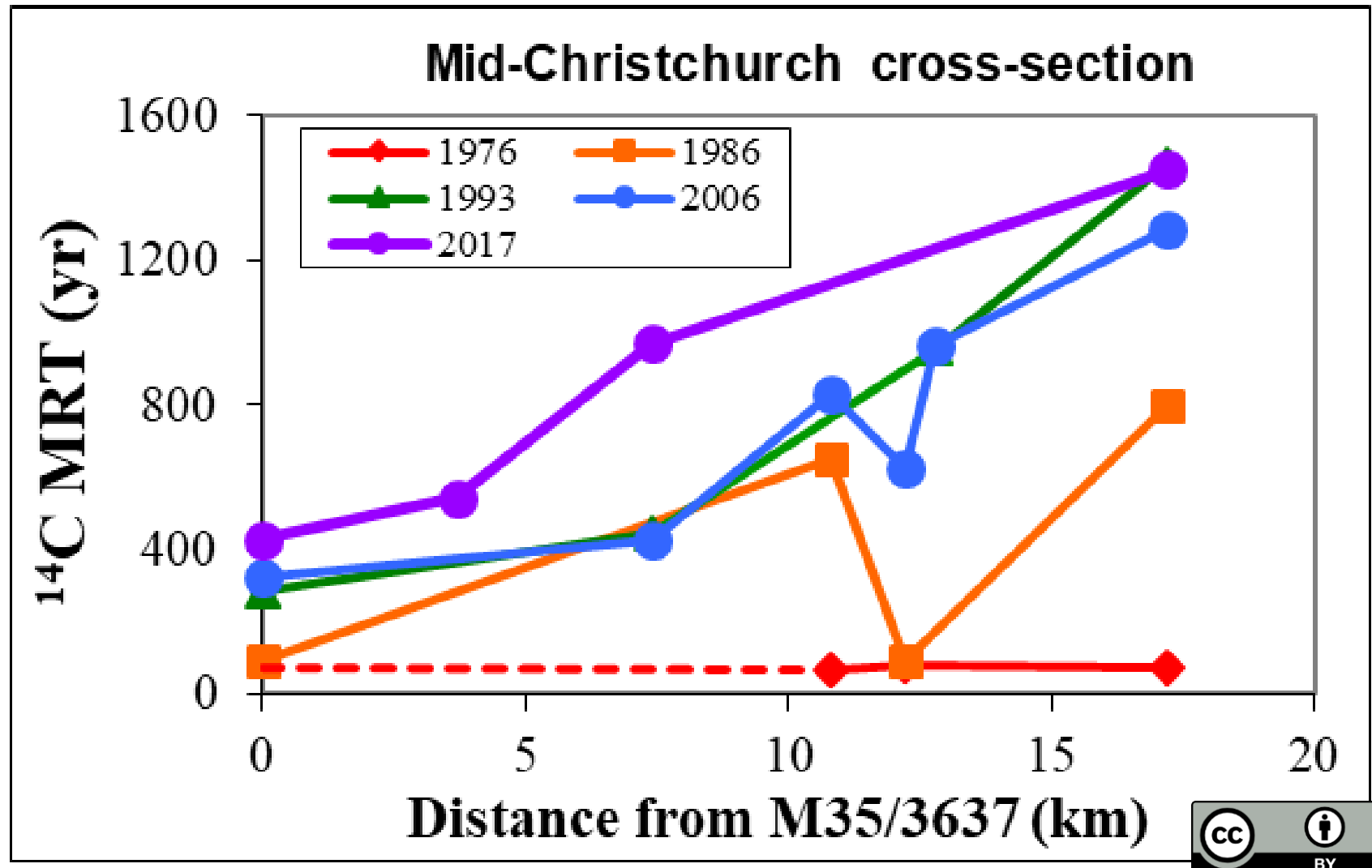




# South transect mean ages in 2017



# Comparison with previous carbon-14 age surveys across Christchurch



## 5. Conclusions (source)

1. Recharge is from the Waimakariri River and land surface recharge (LSR)
2. 1976 samples suggest nearly pure river water
3. 1994 & 2006 samples indicate about 15% LSR
4. 2017 samples indicate about 15% LSR

# Conclusions (age dating)

1. 1970s - ages young (70 years)
2. 1980s - ages and gradient across Christchurch increasing
3. 1990s & 2000s – ages and gradient increasing then steady
4. 2017 – ages and gradient still increasing

# References

**Etheridge, Z., Hanson, M., 2019. Christchurch (NZ):  
Environment Canterbury. Technical Report R19/77.**

**Stewart, M.K., 2012. *J. Hydrol.* 430-431, 50-68.**

