

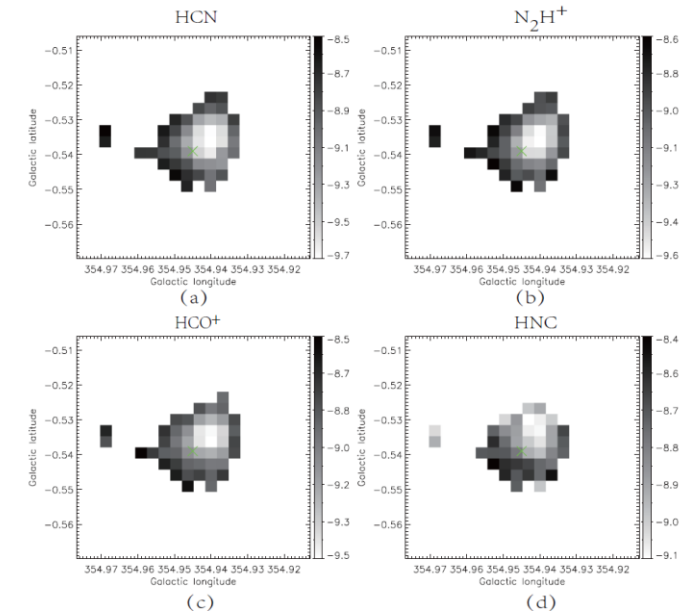
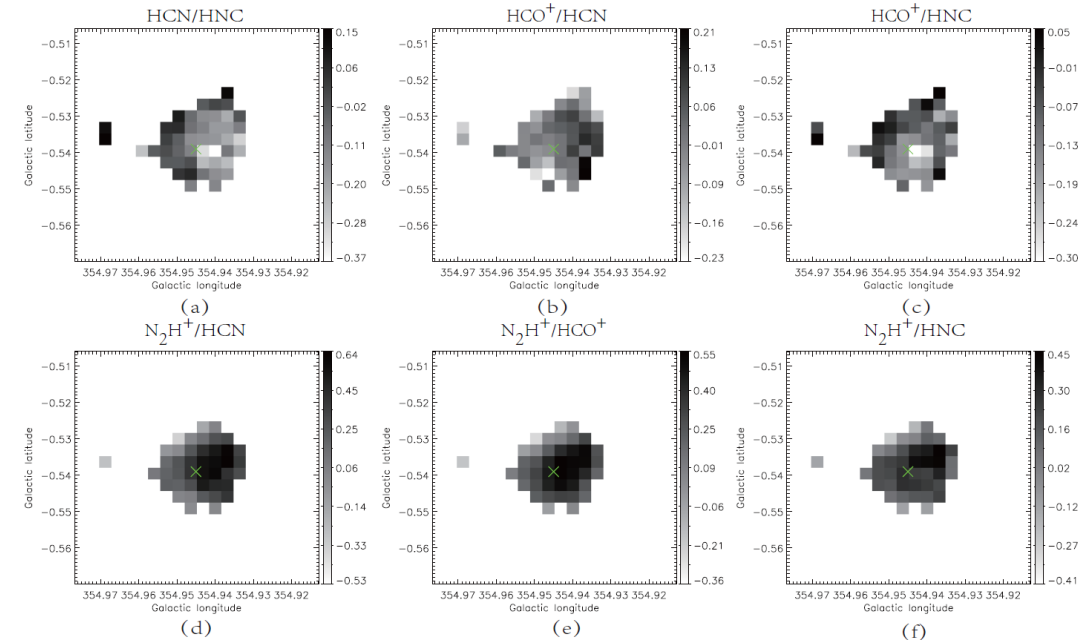
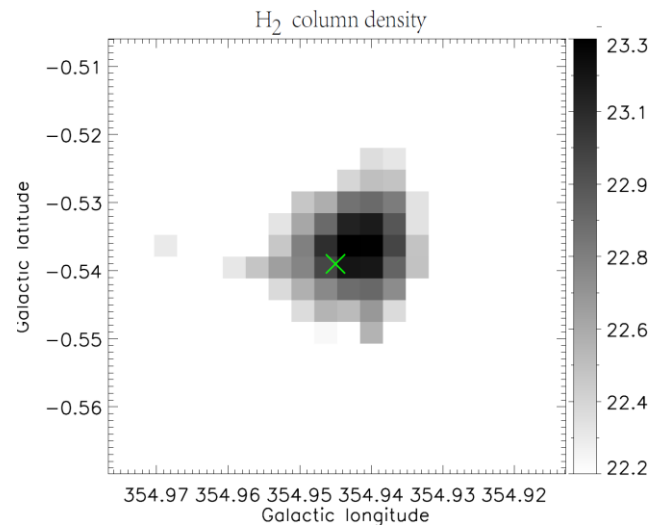
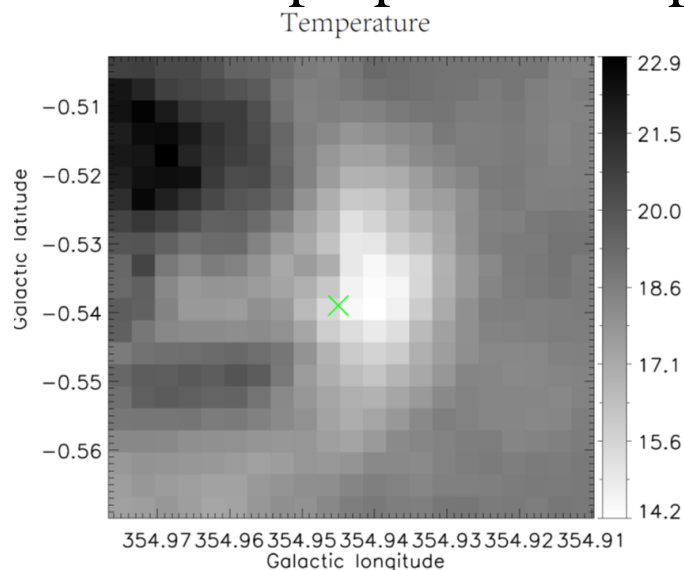
# The spatial variations of chemical properties of massive star forming regions

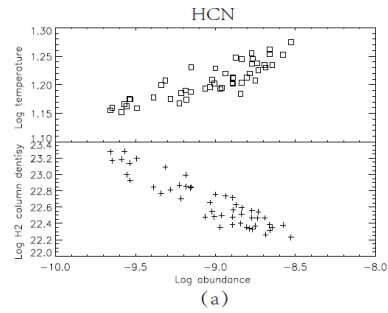
Li, Zhou, Esimbek et al. 2019, ApJs, in press

Many authors have focused on the chemical evolution of massive star forming regions (Gerner et al. 2014; Miettinen 2014; Hoq et al. 2013; Sanhueza et al. 2012, 2013; Vasyunina et al. 2011, 2012; Jin et al. 2015).

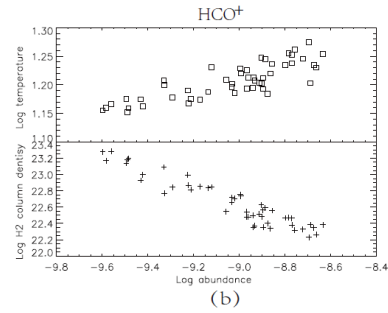
**However**, these studies did not always yield fully consistent results.

We selected 90 massive star forming clumps from MALT90 survey, and studied the spatial variations of the chemical properties and possible reasons

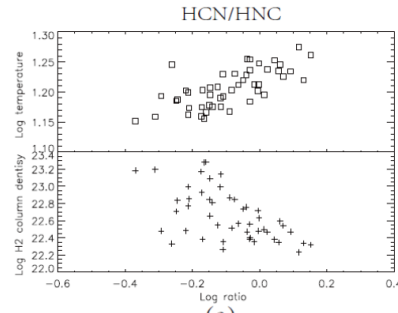




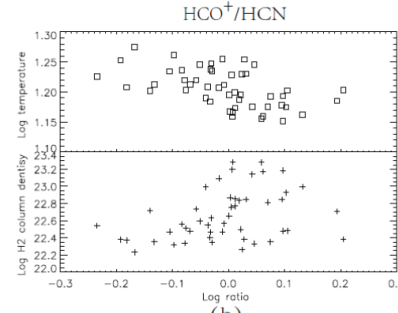
(a)



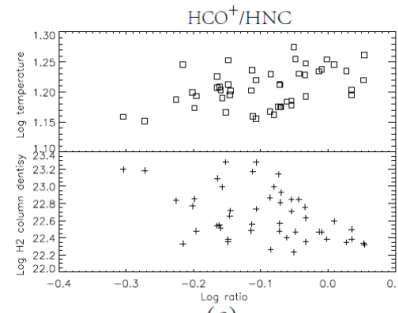
(b)



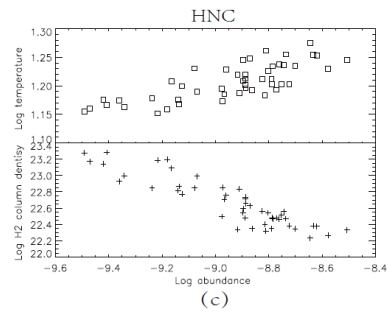
(a)



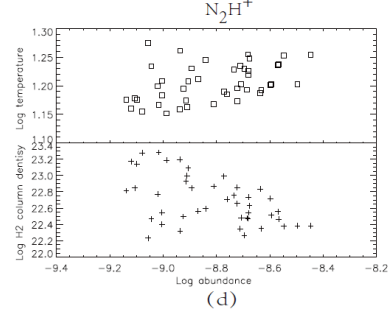
(b)



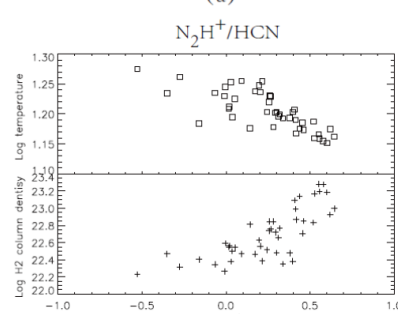
(c)



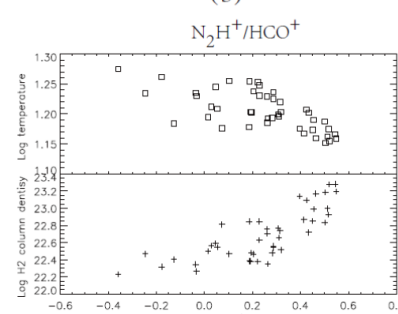
(c)



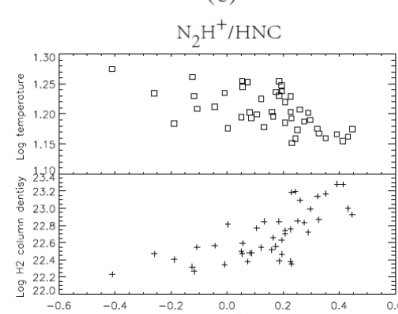
(d)



(d)



(e)



(f)

## conclusion

All clumps show obvious spatial variations of abundance and abundance ratios.

The spatial variation of massive star forming regions are mainly dominated by H2 column density.

So it is difficult to get an accurate chemical clock for star forming clumps.