

"The Compact Group - Fossil Group Connection:  
Observations of a Massive Compact Group at  
 $z=0.22$ " by Claudia L. Mendes de Oliveira and  
Eleazar Rodrigo Carrasco, 2007, **0710.3347**.

# Practice III

## Modulo III: Dra Valeria Mesa

Mary Verdugo - 5th July, 2024

# Fossil groups

## selected catalogue

**Credits:** X-ray: NASA/CXC/E.O'Sullivan et al; Optical: DSS

- **Definition:**

- $\Delta m_{1,2} > 2$  in the r-band  
(Jones+2003)
- $L_{x,bol} > 10^{42} ergs^{-1}$

- **Characteristics:**

- Importance in evolution of compact groups and clusters with low fraction of  $L^*$  galaxies

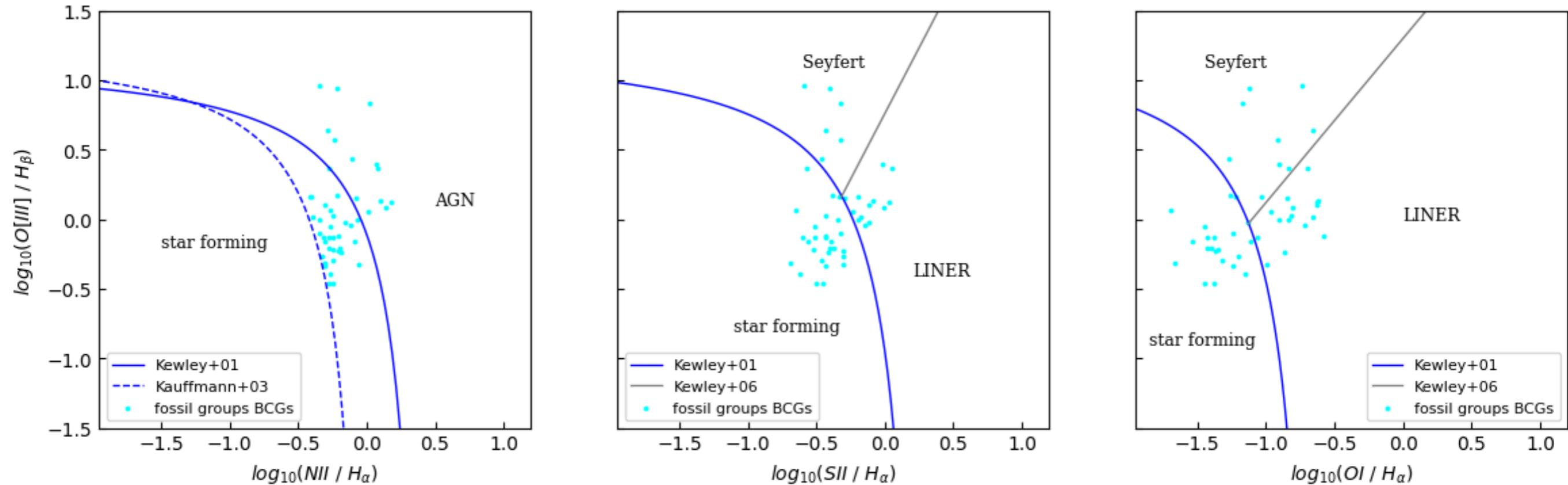


# La Barbera 2009

## selected catalogue

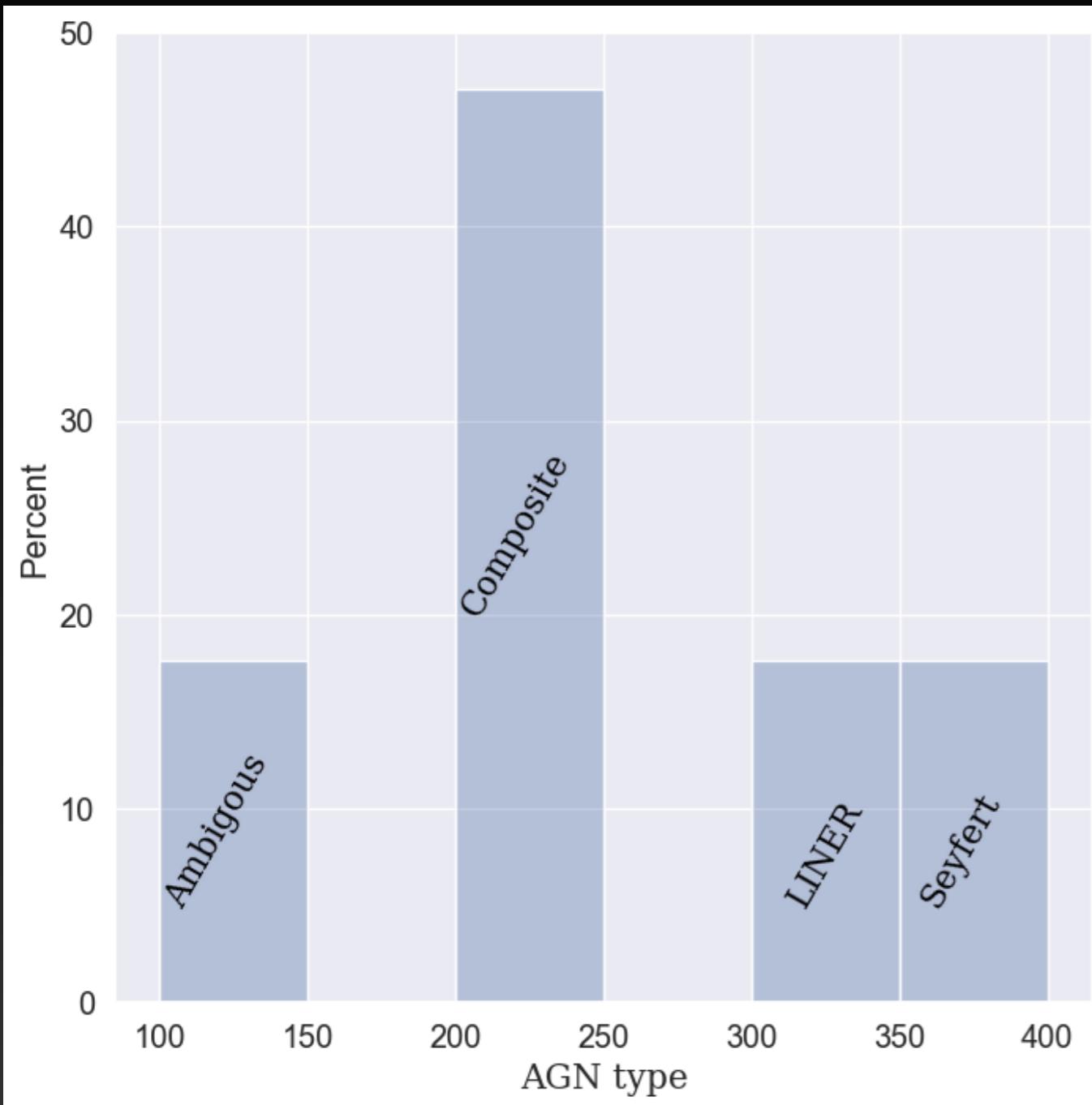
- 91563 galaxies del DR4
- $M_r$  brightness than -20
- $z_{\text{spec}}$  para  $0.05 - 0.095$  ( $\sim 0.1$ )
- petrosian magnitudes
- $\Delta M_{\text{min}} \rightarrow 15 - 25$  ✓
- Groups selected using a cylinder →  $\Delta Z$  → error  $\sim 2000$  km/s  
→  $\Delta D$  ( $\sim \text{Mpc}$ ) → 0.3 a 0.6 Mpc
- Source of contamination :
  - (1) spiral galaxies
  - (2) AGN
  - (3) super position with rich clusters ✓
- X-ray emission → closest → fit Moffat distribution

# BPT diagram



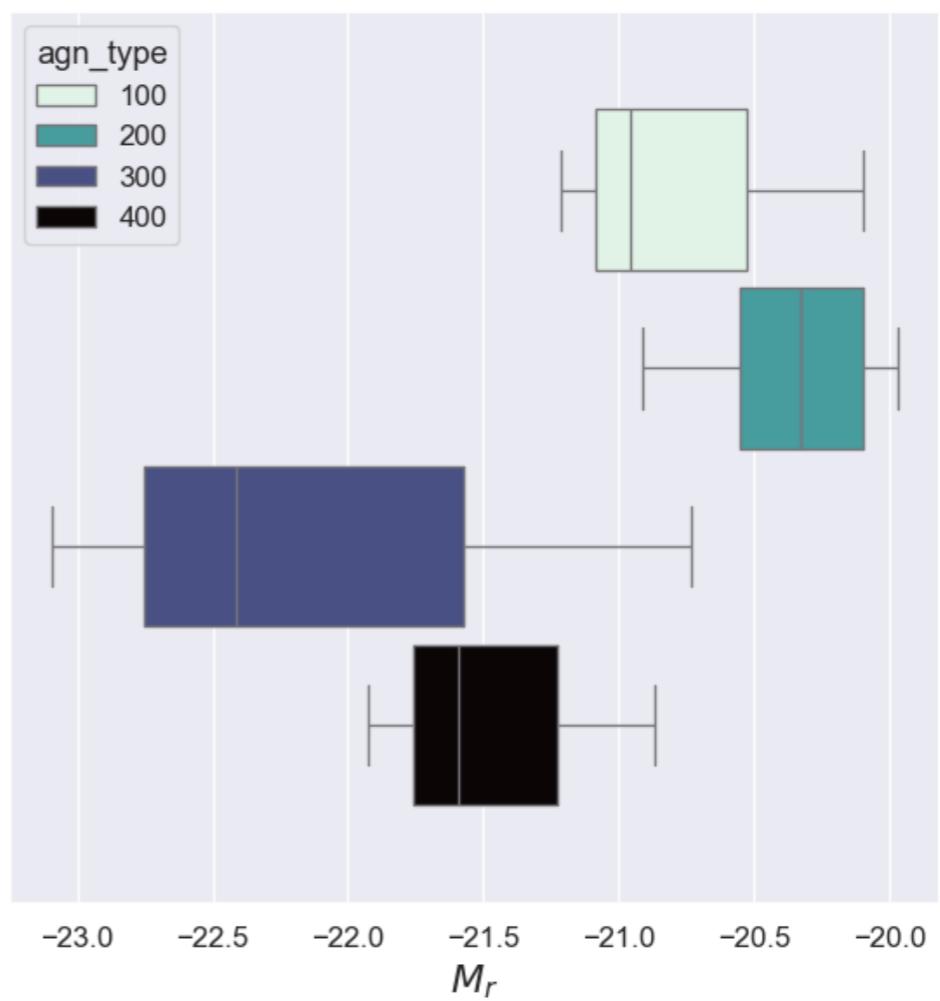
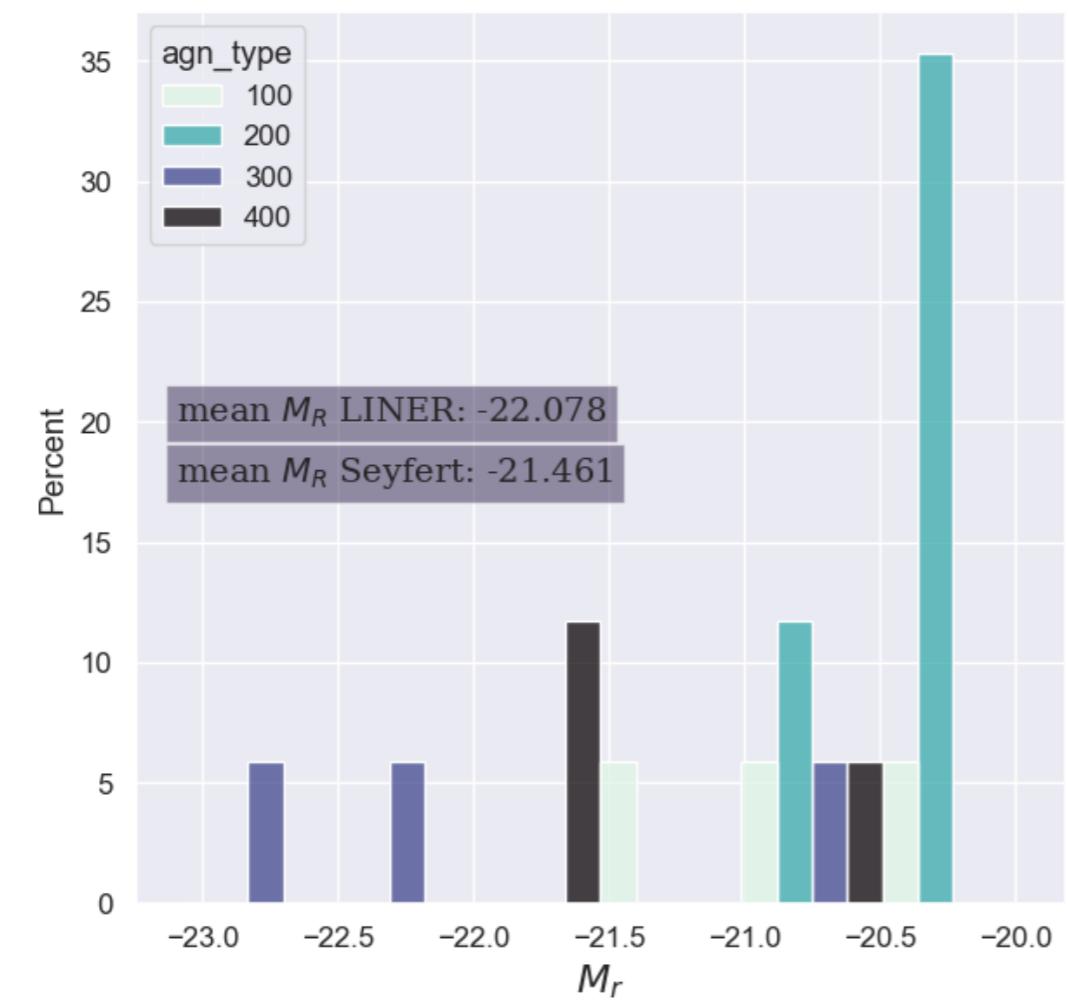
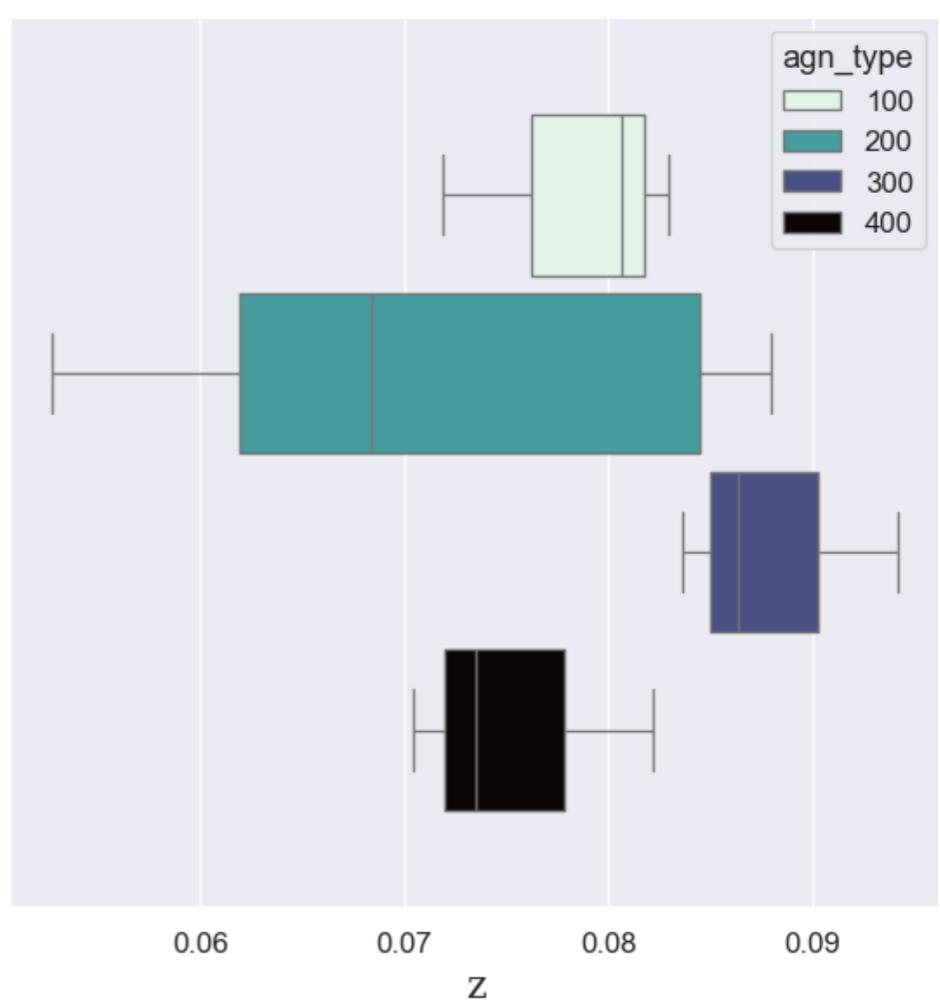
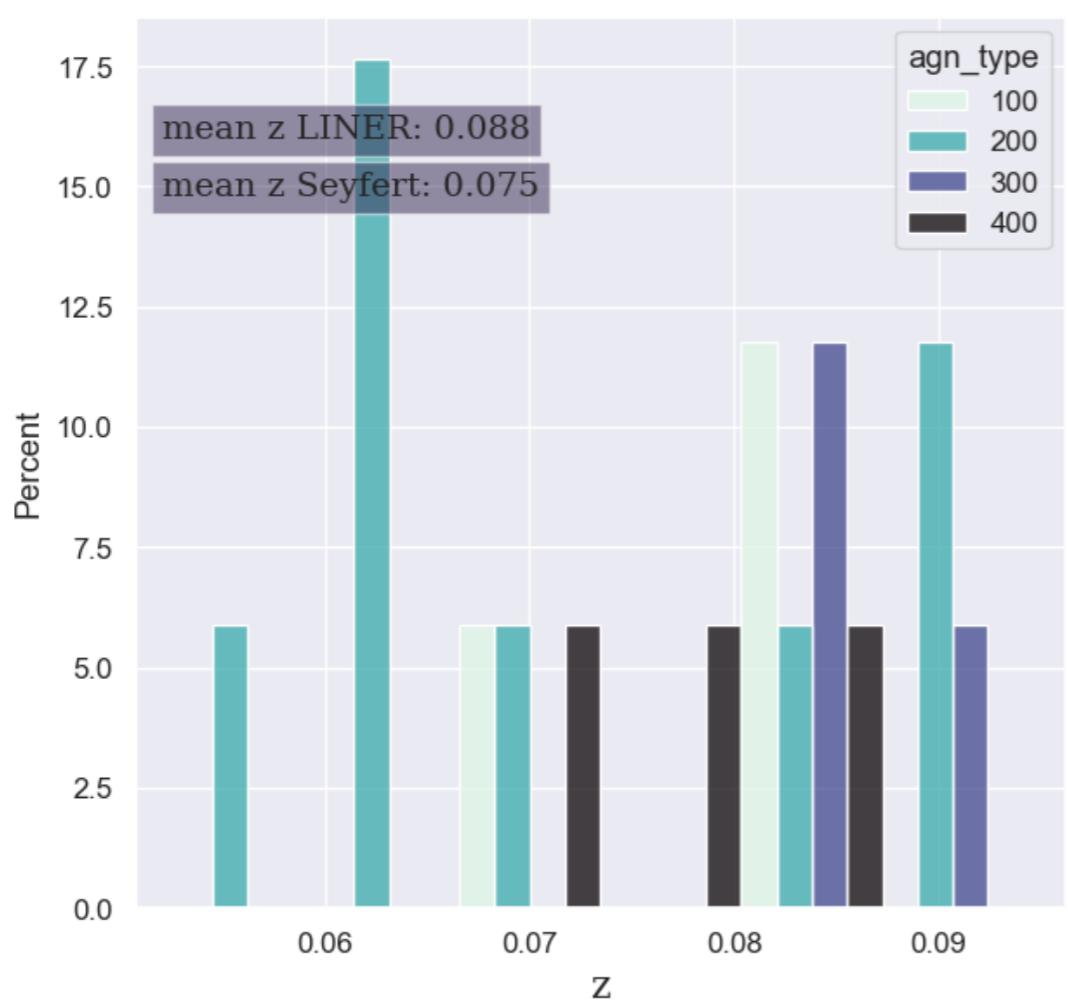
LINERS can be distinguished from normal HII regions and normal AGN's (Seyfert & QSO's) using:  
 $[OIII]5007/H\beta 4861, [NII]6583/H\alpha, [SII]\lambda\lambda 6716, 6731/H\alpha$

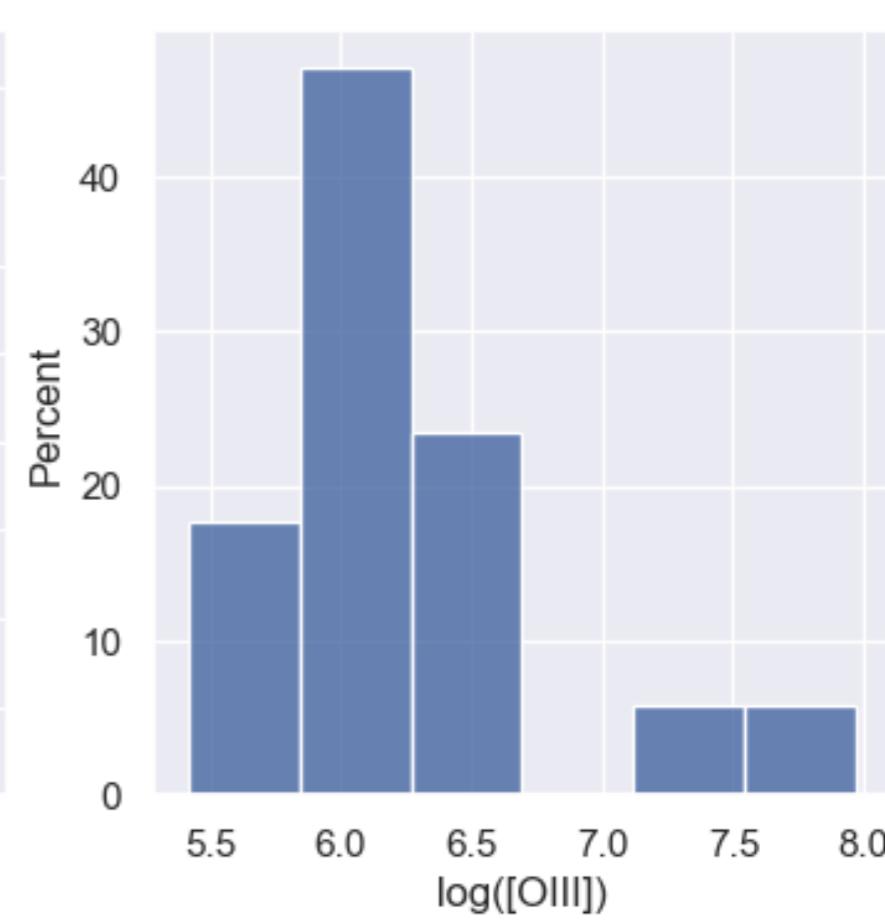
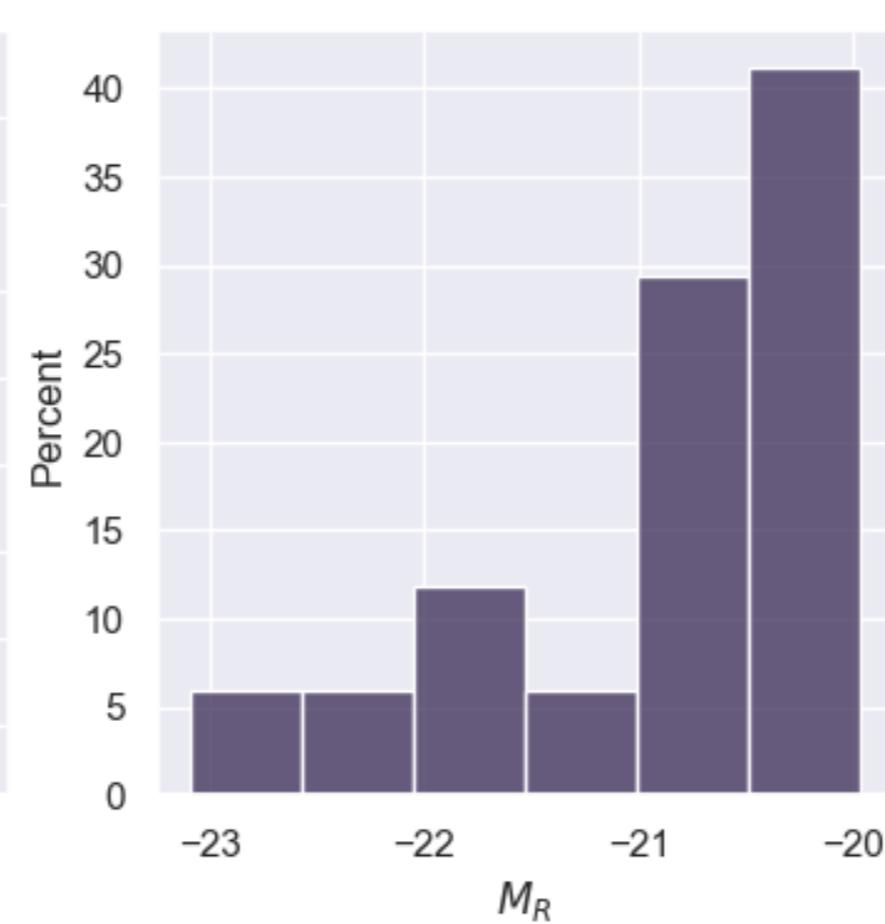
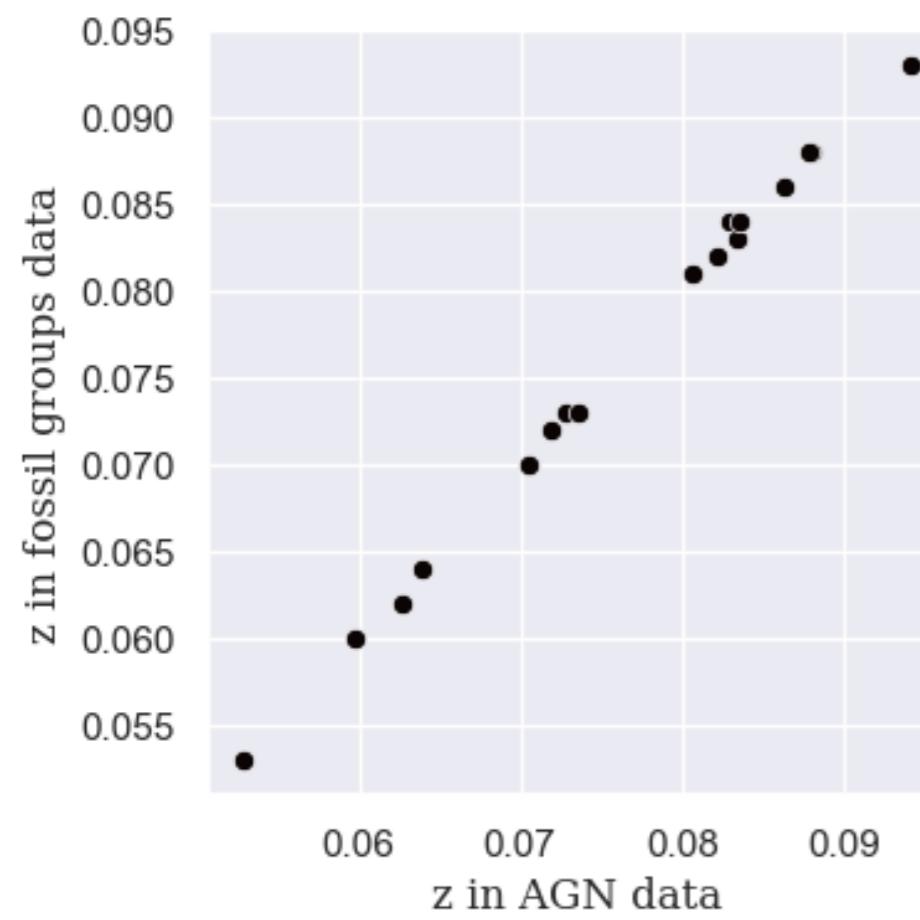
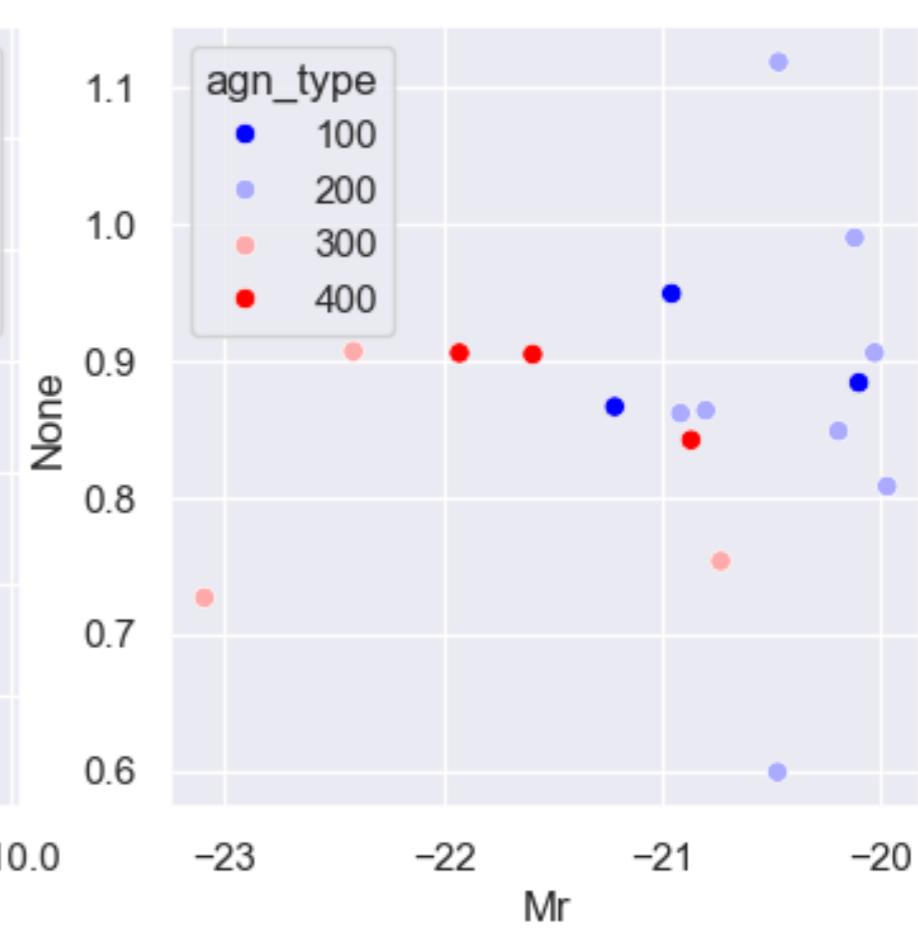
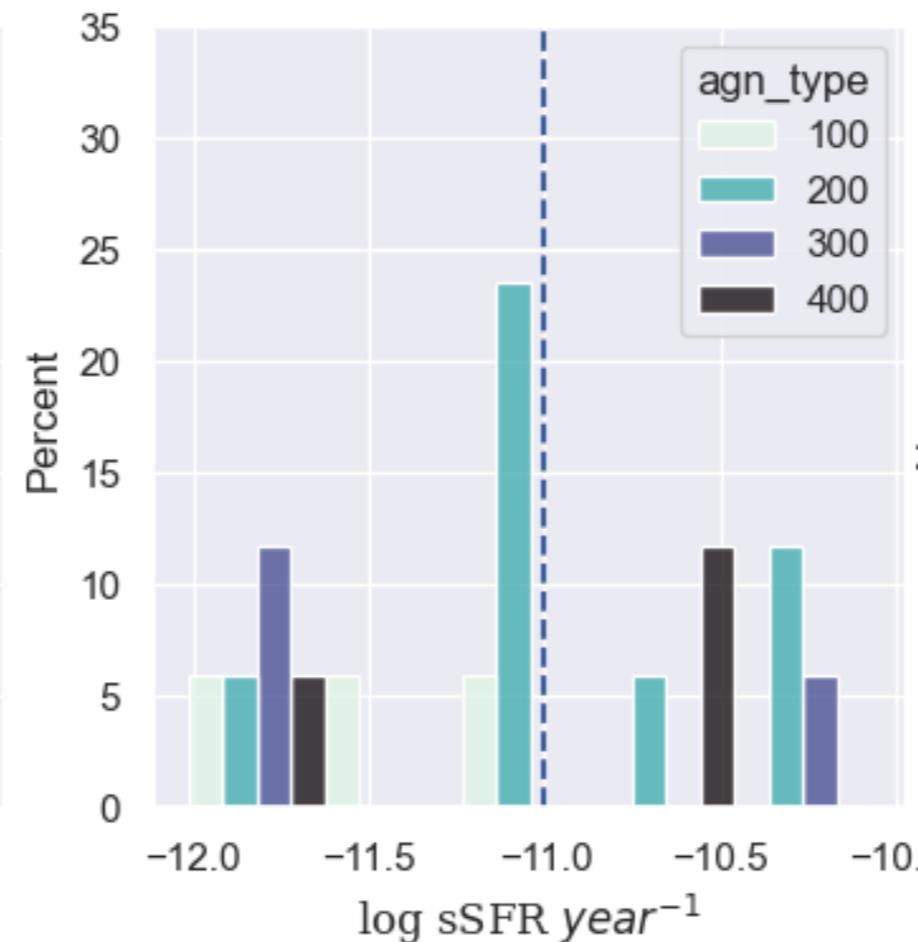
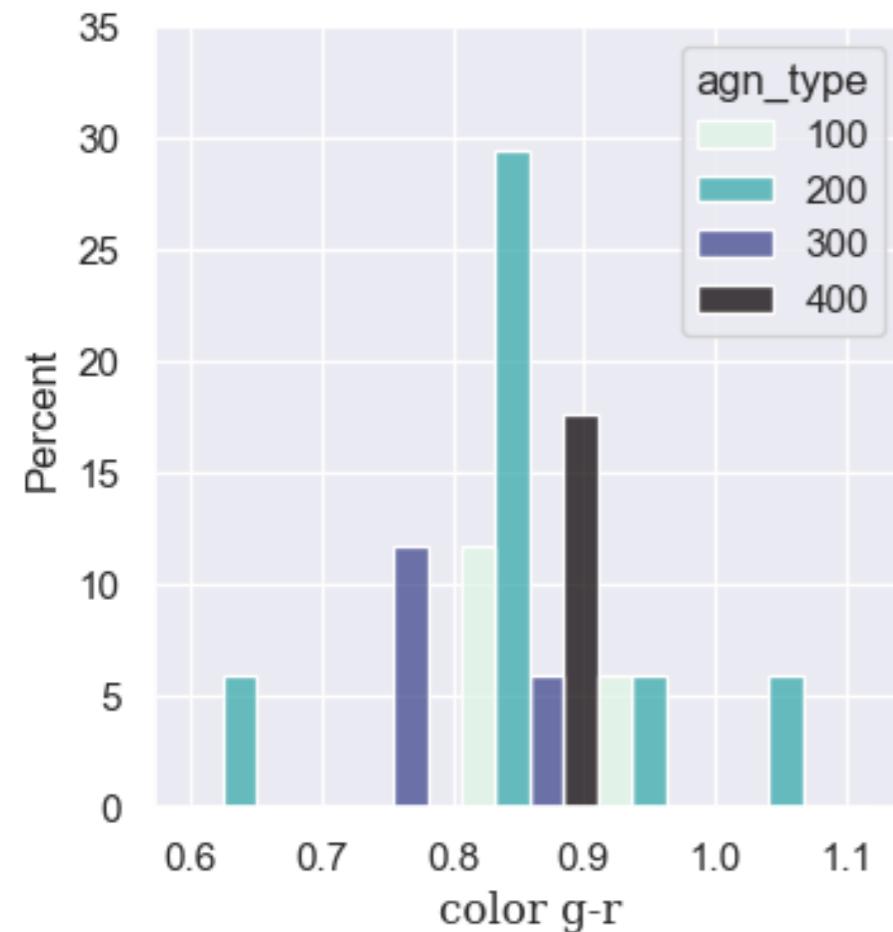
# AGN distribution

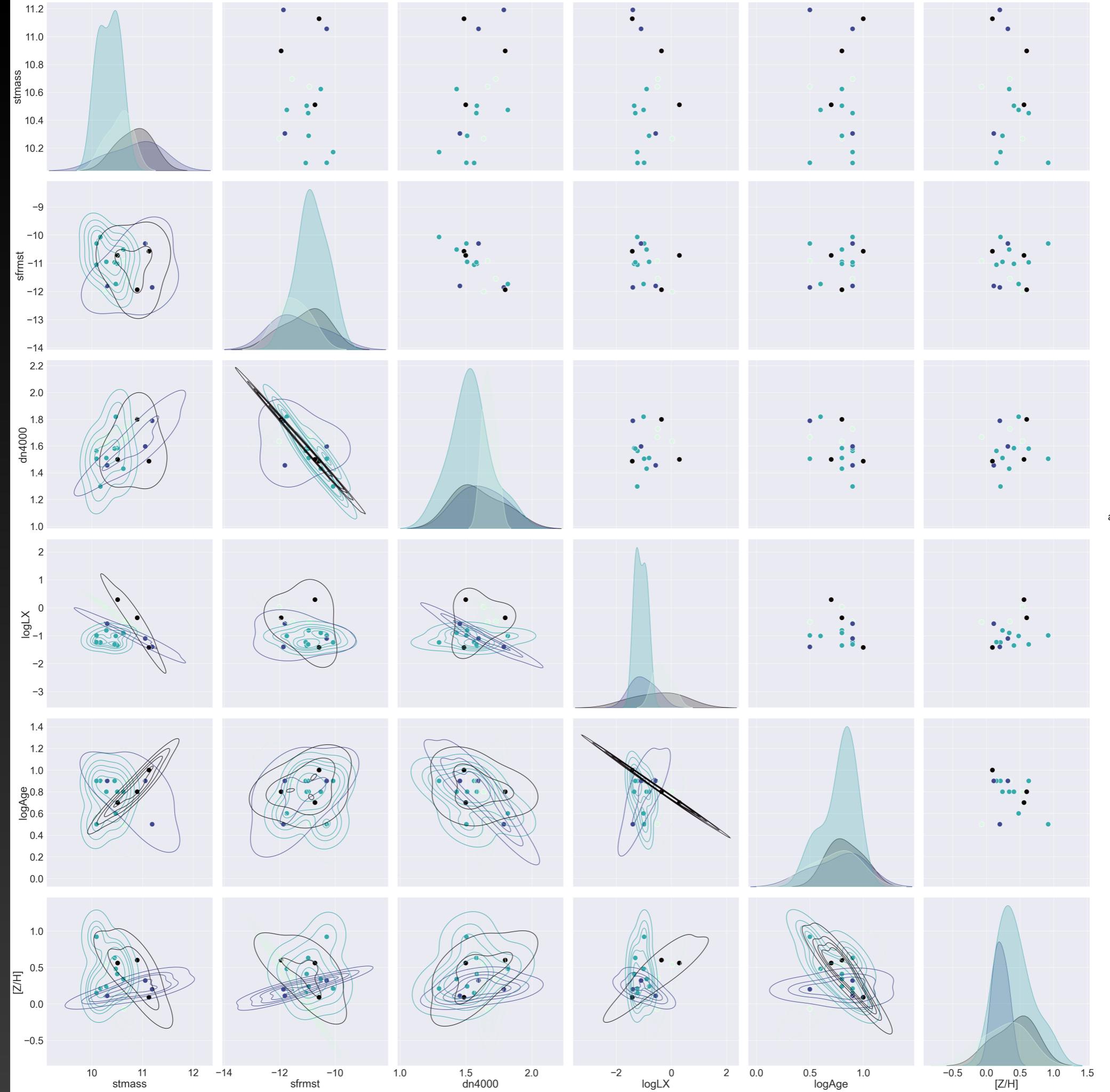


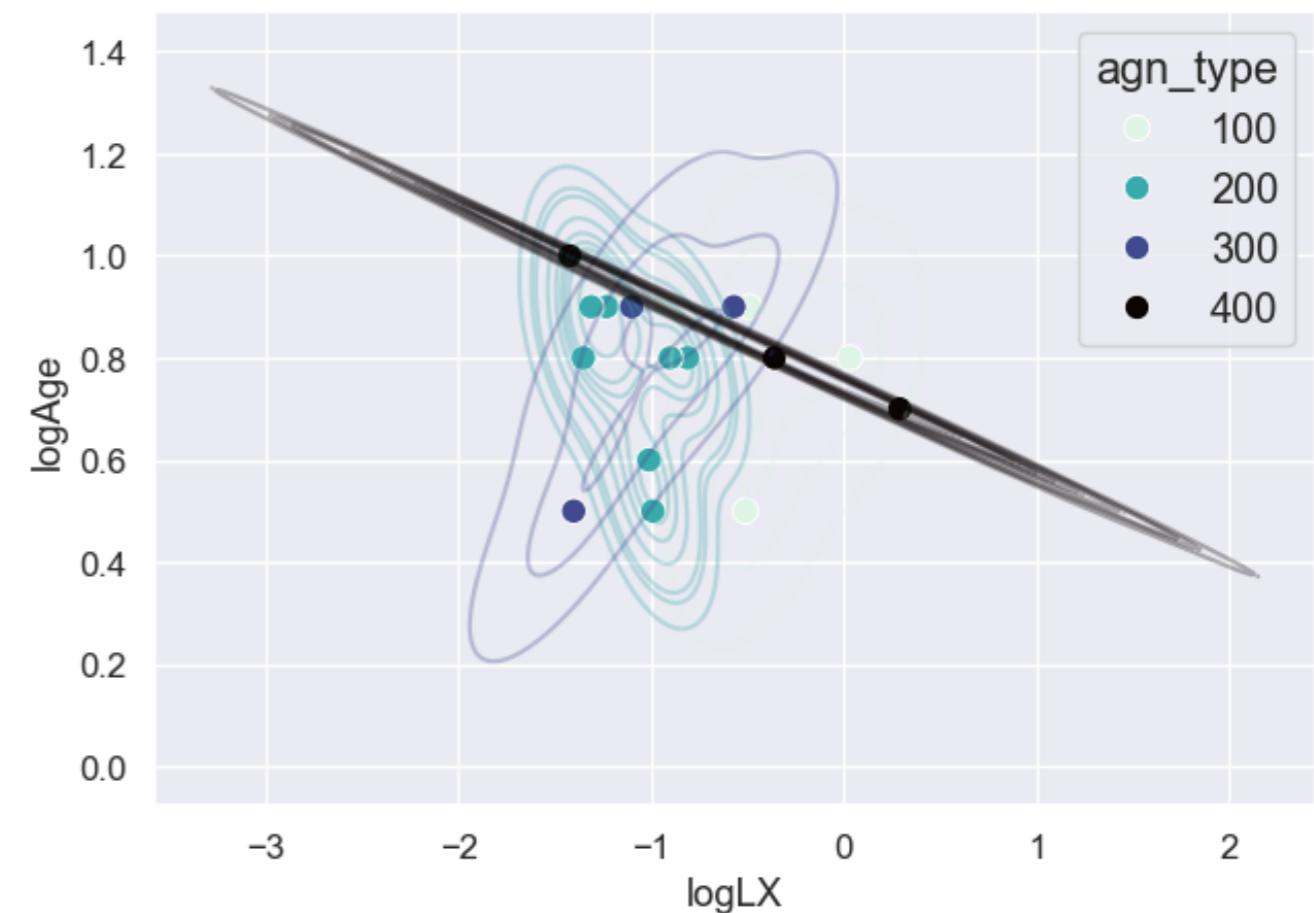
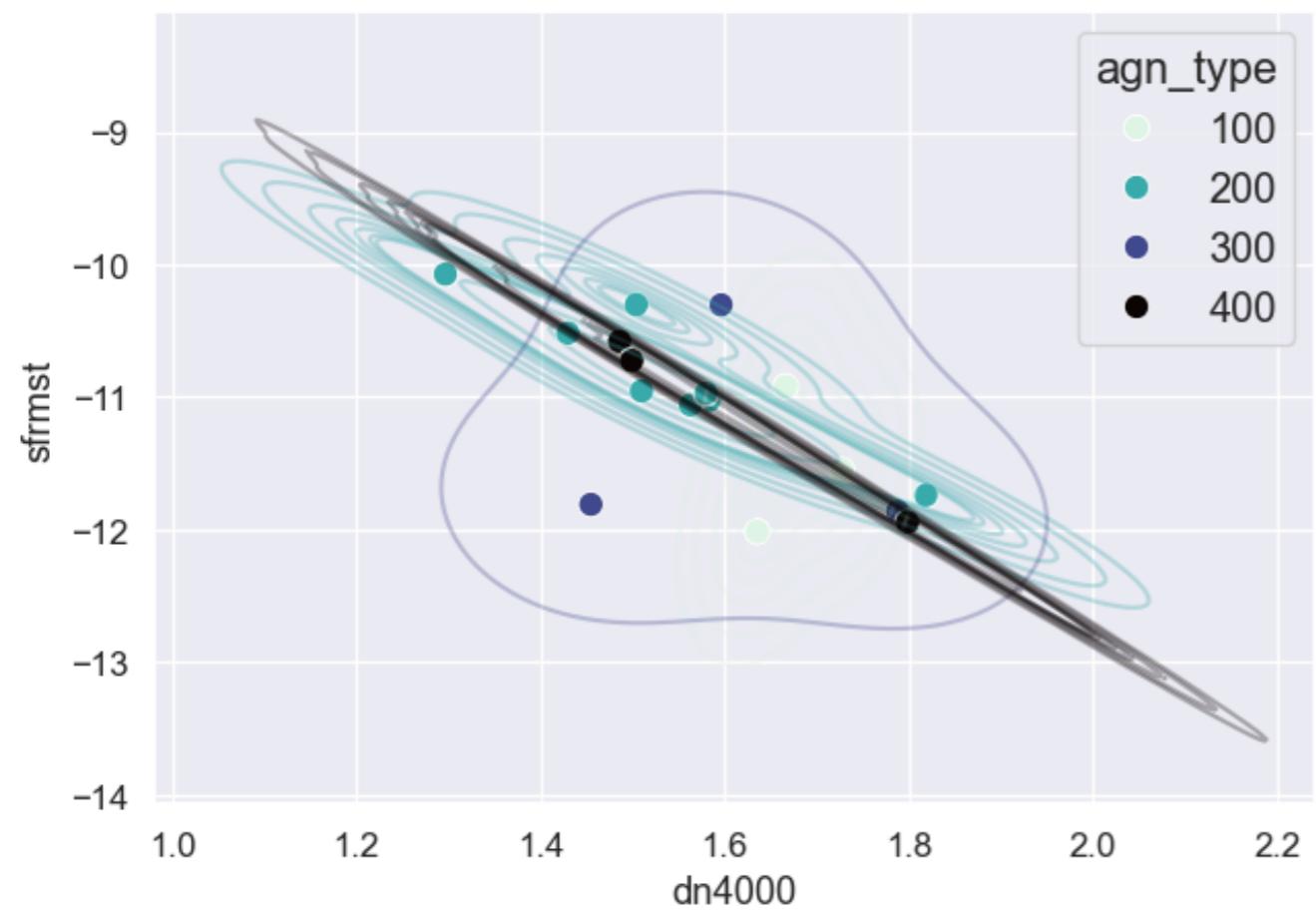
**47% composite**  
**17.6% Ambiguous**  
**17.6% LINER**  
**17.6% Seyfert**

\* Total of member in  
the sample of fossil groups: 17









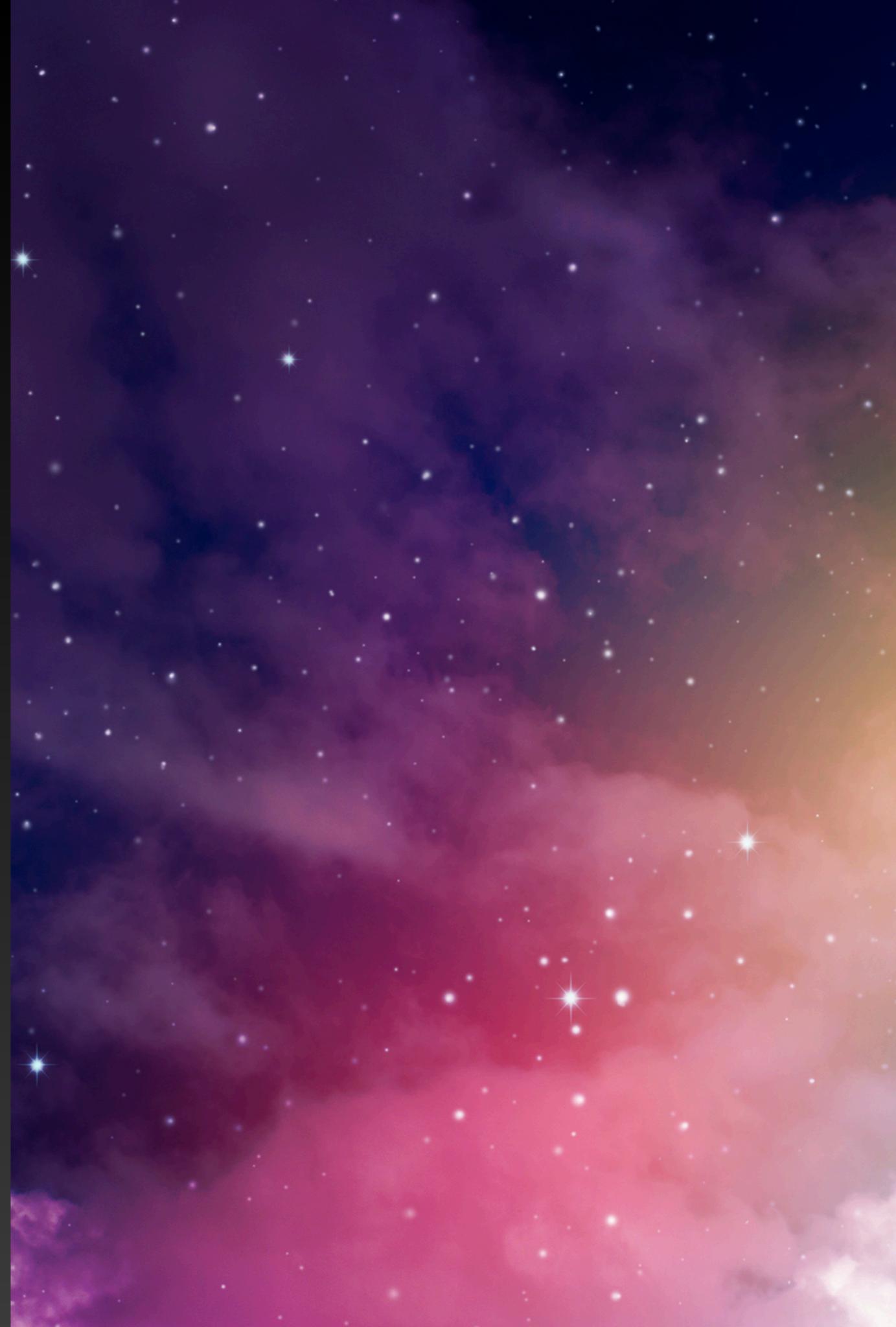
# Final remarks & Conclusions

# References

Paulino-Afonso, A., Sobral, D., Darvish, B., Ribeiro, B., Smail, I., Best, P., Stroe, A., & Cairns, J. (2020). VISCOS. III. Environmental effects on the star formation histories of galaxies at  $z \approx 0.8$  seen in [O II], H $\delta$ , and Dn4000. *åp*, 633, A70.

Mesa, V., Duplancic, F., Alonso, S., Coldwell, G., & Lambas, D. (2014). Interacting galaxies: corotating and counter-rotating systems with tidal tails. *Mnras*, 438(2), 1784-1793.

La Barbera, F., de Carvalho, R., Rosa, I., Sorrentino, G., Gal, R., & Kohl-Moreira, J. (2009). The Nature of Fossil Galaxy Groups: Are They Really Fossils?. *Aj*, 137(4), 3942-3960.



Mean and Width Values of the Distributions of Several Quantities for FG and FS Galaxies<sup>a</sup>

Quantity	FG		FS		KS
	Mean (2)	Width (3)	Mean (4)	Width (5)	
(1)					(6)
$^0.1M_r$	$-22.64 \pm 0.09$	$0.37 \pm 0.07$	$-22.45 \pm 0.09$	$0.37 \pm 0.05$	0.36
$\delta_N$	$2.5 \pm 0.4$	$1.56 \pm 0.30$	$2.5 \pm 0.5$	$2.0 \pm 0.4$	0.99
$\log R_e$ (kpc)	$1.13 \pm 0.08$	$0.29 \pm 0.06$	$0.97 \pm 0.08$	$0.35 \pm 0.10$	0.23
$n$	$5.4 \pm 0.6$	$2.4 \pm 0.6$	$5.5 \pm 0.6$	$2.5 \pm 0.4$	0.83
$a_4 * 100$	$0.11 \pm 0.26$	$0.6 \pm 0.3$	$0.3 \pm 0.2$	$0.75 \pm 0.11$	1.00
$\nabla(g - r)$	$-0.072 \pm 0.026$	$0.09 \pm 0.06$	$-0.17 \pm 0.08$	$0.25 \pm 0.08$	0.74
$\log L_X(\cdot 10^{44} h_{75}^{-2}$ erg s $^{-1}$ )	$-0.90 \pm 0.09$	$0.41 \pm 0.13$	$-0.84 \pm 0.15$	$0.52 \pm 0.11$	0.44
$\delta_{CM}$	$0.0 \pm 0.3$	$0.8 \pm 0.4$	$-0.5 \pm 0.3$	$1.1 \pm 0.2$	0.29
$\log \sigma_0$ (km s $^{-1}$ )	$2.43 \pm 0.01$	$0.07 \pm 0.01$	$2.42 \pm 0.04$	$0.09 \pm 0.05$	0.40
$\log Age$ (Gyr)	$0.72 \pm 0.03$	$0.14 \pm 0.03$	$0.77 \pm 0.04$	$0.16 \pm 0.04$	0.10
[Z/H]	$0.44 \pm 0.03$	$0.17 \pm 0.02$	$0.34 \pm 0.06$	$0.24 \pm 0.05$	0.29
$[\alpha/Fe]$	$0.27 \pm 0.02$	$0.10 \pm 0.01$	$0.28 \pm 0.03$	$0.12 \pm 0.02$	0.93

- Ellipticals in HCGs have higher ages and lower metallicities than both FGs and field galaxies, showing no correlation between [a/Fe] and velocity dispersion.
- FGs and field galaxies occupy the same region in the diagrams of age and metallicity versus velocity dispersion  $\Rightarrow$  similarity of both samples.

# Extra: Paper results

- $a_4$ , which measures isophotal shape deviations from a pure ellipse, indicates that FGs and field ellipticals are similar.
- no difference in age, metallicity, or  $\alpha$ -enhancement, indicating that the star formation history is similar
- FGs are not significantly different from bright ellipticals found in low-density regions of the universe.
- FGs could simply be “failed” groups a few relatively bright galaxies merged forming the dominant system we see today, but without enough surrounding matter to form additional nearby bright galaxies, resulting in an atypical LF.
- infall of  $L \approx L_\star$  systems along filaments with impact parameters as small as 5 kpc.
- fossil groups at low redshift might not be true fossils
- these systems may represent the final stage of mass assembly as suggested in the analysis of the Millennium simulation by Dariush et al. (2007), instead of forming a distinct class.