dances by number. From that figure, we can say that a non-negligible fraction of the stars in the direction of the bulge might belong to the inner disk. Moreover, about the bulge sample we note that: (i) for 12+log(Fe/H) < 7 the contamination of the thick disk is high, (ii) for $7 < 12 + \log(\mathrm{Fe/H}) < 8$ the contamination of the thin disk is lower and the true bulge stars dominate, and (iii) for 12+log(Fe/H) > 8 the contribution of the metal-rich stars of the thin disk is important.

Note that in Figure 11 we are using only the outermost 104 stars of the total of 800 stars located in the direction of the bulge, and the results of our model for $r = 3$ kpc. On the other hand Cescutti & Matteucci (2011) show that their bulge model (the same as Cescutti et al. 2009) follows the constraint provided by the 800 stars very well using a Salpeter IMF. The model by Cescutti and Matteucci predicts a smaller number of stars for [Fe/H] values higher than solar, probably indicating that the bulge sample has been contaminated by innermost disk stars.

From the previous discussion it follows that the Galactic bulge is a complex structure that should be studied further (e.g., Zoccali 2010).

7. CONCLUSIONS

We have constructed models with three different sets of yields that differ only on their Z dependence at solar metallicities for massive stars: HWY, IWY, and LWY. The HWY and the LWY have been used before by us, while in this paper we introduce the IWY, that are given by (HWY + LWY)/2. We find that the IWY Galactic chemical evolution models produce better fits to the observational data than either the HWY or the LWY models.

We present a Galactic chemical evolution model based on the IWY for the disk of the Galaxy that is able to fit: (a) the C/O vs O/H, C/Fe vs Fe/H, O/Fe vs Fe/H, and Fe/H vs t relations derived from halo and disk stars of different ages in the solar vicinity, (b) the O/H, C/H, and C/O abundance gradients (slopes and absolute values) derived from Galactic H II regions, (c) the He/H, C/H, O/H, Fe/H protosolar abundances, and (d) the He/H and O/H values of the Galactic H II region M17.

We find that in general about half of the freshly made helium is produced by massive stars and half by LIMS, and that a similar situation prevails for carbon, while most of the oxygen is produced by massive stars. The agreement of the He/O and C/O ratios between the model and the protosolar abundances implies that the Sun formed from a well mixed ISM.

We note that the agreement of our model with the protosolar abundances and the Sun-formation time supports the idea that the Sun originated at a Galactocentric distance similar to that of the solar vicinity.

We show that chemical evolution models for the Galactic disk are able to reproduce the observed ΔY and ΔO protosolar values and the ΔY and ΔO values derived for M17 based on H, He and O recombination lines, but not the M17 ΔY and ΔO values derived from $T(4363/5007)$ and O collisionally excited lines under the assumption of $t^2 = 0.00$. This result provides a consistency check in favor of the presence of large temperature variations in H II regions and on the method based on the H, He, C and O recombination lines to derive abundances in H II regions.

We obtain that the IWY chemical evolution model of the Galactic disk for the present time, in the Galactocentric range $6 < r(\mathrm{kpc}) < 11$, produces a reasonable fit to the O/H vs C/O relationship derived from H II regions of nearby spiral galaxies. The yields predict an increase of the C/O ratio with O/H starting from 12+log(O/H)$\sim$8.4 which is observed in our Galaxy and in nearby galaxies. The O/H vs C/O relationship might imply that spiral galaxies have a similar IMF, no selective outflows, and probably a formation scenario similar to that of our galaxy.

We find a remarkable parallelism of the O/H gradients for M33, M101, and the Galaxy when they are plotted with respect to r/R_0 (R_0 is the galactic photometric radius to 25 mag per square second), suggesting some common mechanisms in the formation and evolution of spiral galaxies. The O/H ratio at a given r/R_0 differs by a constant among M33, M101 and the MW. The MW shows a 0.24 dex higher O/H ratio than the average of M33 and M101 at a given r/R_0.

We also find that the results for our model at $r = 3$ kpc can explain: (a) the C/O-O/H and O/Fe-Fe/H relations, and (b) partially the Fe/H-time relation and the Fe distribution function derived from stellar observations in the direction of the Galactic bulge. We find that stars belonging to the thin and thick discs make a significant contribution to these relations.

Future work to advance in this subject requires: (a) further studies of the Galactic bulge to be able to quantify the stellar contributions due to the inner disk and the true bulge; (b) to increase the H II regions r/R_0 coverage, mainly for the smaller galactocentric distances, with high accuracy C/H and O/H abundance determinations; (c) to increase the sam-