

# Application cases of integrated shale gas drilling technology

## Technology introduction

Antonoil has made many records and formed a high standard technical template for shale gas drilling after years of operating, exploring and experience gaining. Antonoil continuously improve the technologies for shale gas drilling: such as integrated drilling design, advanced technology adaptation optimization, detailed management and integrated operating model utilization, comprehensively applied Rotary steering, biosynthetic drilling fluid, elastic cement slurry, rotary casing running, string torsion swing system etc.

## Technology states

Antonoil has been working in the shale gas market for many years. Initially entered the Zhejiang oilfield market in 2014 and fully operated in Changning market in 2017. Now there are 4 Antonoil drilling rigs working for Changning market - 9 wells had been drilled, 8 of them had been finished. the total footage is 43,616 m since the first drilling rig moved in on 7th Feb, 2018.

## Application case

- ① Well Ning209H20-xx,drilling cycle 51.19 days,has set the record of the shortest drilling cycle for Wells above 5000m in 209 block of changning, saving 23.81 days compared with the average drilling cycle of adjacent wells. Single PDC bit footage is 1165m, with an average ROP of 11.15 m/h and the drilling cycle is only 12.31 days, 6.85 days shorter than the design in 311.2mm hole section.Drill through the SHINIULAN formation ,high abrasive formation, in one trip (interval 2600-2955m , 355m footage) in 215.9mm hole section. At the same time, use the BAKER RSD tool to complete the footage in one trip in deflecting section and horizontal section (interval 3071-5100 m, footage 2029 m);The horizontal section of this well has a maximum deviation of 107.94°, which is a high-tech well in changning shale gas field.In the completion operation,rotating casing to make the casing run smoothly in one time.
- ② Well Ning209H11-xx,through optimizing drilling bit and parameters in 311mm hole section , complete drill footage 1078 m (758-1836 m interval), net drilling time 83.5 h, ROP of 12.91 m/h in one trip , only took two trips to drill to the STD, achieved the goal for improving the drilling rate.
- ③ Well Ning209H16-xx, by using BAKER RSD tool in deflecting section and horizontal section, realized drilling footage1960 m in one trip, in 215.9 mm hole (interval 2890-4850 m , net drill time 241.5 h, the average ROP 8.11 m/h, operating cycle 14.83 days), achieved the goal for improving the drilling rate in target formation.
- ④ Well Ning209H13-xx, through optimizing drilling bit and mud motor, reinforcement drilling parameter in 311.2 mm hole section, complete one-day drill footage of 450 m, achieved the goal for improving the drilling rate.
- ⑤ Well Ning209H20-xx,used PDC bit +1.25° mud motor BHA and torsion pendulum system at 4729 m to meet requirements of geosteering for well trajectory adjustment (well depth of 5000m, WOB 17 tons, slide drilling time of 20min/m,rotary drilling time 4-6min/m), which can solve many technical problems under extremely complex well conditions ,such as the great friction and drag force and horizontal section extension while sliding drilling, and meet the geological requirements of company.

